

MEXT

**TÜRKİYE'S
MANUFACTURING TRANSFORMATION
INSIGHTS REPORT**

2026

5 YEARS | 500 FACTORIES

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Chairman's Message



Özgür Burak AKKOL

Chairman of the Board, MESS

The rules of competition in industry are being redefined. While digital and green transformation are reshaping production models, AI is unlocking new opportunities. As global uncertainties increase, supply chain resilience is becoming more critical than ever, while a skilled workforce plays a decisive role in enabling the twin transformation. These areas are no longer independent; they now converge to shape the future of industry. In this new era, it is not only access to technology that matters, but also the ability to prioritize the right solutions, integrate them into operations effectively, and support the transformation with strong organizational capabilities.

In 2020, we established the MEXT Technology Center to accelerate the digital and green transformation of Turkish industry, guide companies, build next-generation capabilities, and strengthen global competitiveness. Our objective is to simultaneously enhance production, employment, sustainability, and social impact while accelerating the industry's adaptation to evolving global conditions.

Since its establishment, MEXT has made significant contributions to the transformation journey of Turkish industry. This report, one of the most valuable outcomes of five years of experience, is built on data obtained from SIRI (Smart Industry Readiness Index) assessments conducted in 500 companies across Türkiye. Covering a broad range of sectors, from automotive to electronics, textiles to chemicals, and energy to metals and mining, it provides a comprehensive view of companies' digital maturity levels, priorities, cost structures, and transformation needs.

One of the key findings of the report is that the digital transformation journey in Türkiye does not follow a single trajectory. While some sectors progress more rapidly under the influence of global value chains, customer demands, and regulations, others, despite certain advancements, struggle to scale their transformation efforts. In particular, gaps in core digital infrastructure, data visibility, and integration stand out among SMEs. This highlights the need for policies to adopt an inclusive approach that addresses not only leading companies but the entire industrial base. In this context, initiatives led by relevant ministries to support SME transformation, backed by both national and international funding, play an important role in strengthening the industrial base.

Sustainable industrial transformation depends on establishing common standards, building strong collaborations, activating appropriate financing instruments, and enhancing workforce capabilities. Close cooperation with public institutions, along with effective collaboration with technology providers, academia, and other stakeholders, is essential for sustained progress. In this regard, we would like to express our sincere thanks to the Ministry of Industry and Technology for our collaboration under the Digital Transformation Program (DDP), and to the Ministry of Labour and Social Security for their contributions to the transformation of working life and the development of a skilled workforce.

In its fifth year, I believe that this report, which we present to Turkish industry, will serve as a strong reference for all stakeholders. The insights, sectoral comparisons, and success stories shared in the report will guide industrial companies throughout their transformation journeys. The future of our industry will be shaped by companies that effectively leverage technology, manage data, develop talent, and place transformation at the core of their business practices. We will continue, with determination, to stand by our industry, provide guidance, and accelerate transformation throughout this journey.

Foreword



Efe Erdem

General Manager, MEXT

At MEXT, we support Türkiye's industrial transformation with a clear understanding: competitiveness in the next decade will be defined by the twin transformation. It requires an integrated approach where digital and sustainability transformations progress together. Our ambition is practice-oriented; with a clear focus on implementation and measurable outcomes. Throughout the transformation journey, we provide step-by-step guidance on roadmap definition, technology selection, and ongoing governance, helping companies mitigate risks and sustain progress. In doing so, we contribute to a more productive, resilient, and globally integrated industrial base for Türkiye.

Over the past years, MEXT has expanded its impact through programs that connect technology adoption with measurable outcomes. We actively contribute to key national and international initiatives that advance industry-wide transformation, including the Ministry of Industry and Technology's Digital Transformation Program (DDP), TÜBİTAK 1831 Program and Developing Women Empowerment Models in Manufacturing Industry Project which is funded by the EU under IPA II Program. As a European Digital Innovation Hub (EDIH), we lead a consortium focused on accelerating digital capabilities and AI for twin transition, while strengthening environmental performance. These collaborations reflect a consistent approach: supporting companies in aligning with national priorities and developing actionable roadmaps.

A key milestone has been our joint work with İş Bankası through the Twin Transformation Journey of 100 SMEs Project applying both the Smart Industry Readiness Index (SIRI) and the Consumer Sustainability Industry Readiness Index (COSIRI) to SMEs across Türkiye. This reflects our belief that the twin transformation should be inclusive and large scale, reaching SMEs alongside large enterprises to strengthen the ecosystem as a whole. The project with İş Bankası equipped SMEs with structured diagnostics and targeted guidance, and the two-year analysis of 100 SMEs across 24 cities and 12 sectors highlighted tangible, measurable outcomes: including a 10–20% increase in productivity, 14–20% savings in energy costs, access to around 10% lower-cost financing through improved alignment with sustainability criteria, and a 20–30% potential uplift in operating profit enabled by digitalization. To date, MEXT has conducted more than 650 SIRI and 150 COSIRI assessments nationwide and globally, building one of Türkiye's richest datasets on industrial digital and sustainability maturity.

This whitepaper aims to synthesize those insights together. It reflects not only maturity levels, but also the patterns behind them where progress is concentrated, where scaling efforts fall short, and what it takes to close the gap. It also benefits from our global engagements such as World Economic Forum and its Global Lighthouse Network, where we work with companies to strengthen readiness and support their pathway to becoming one of the Lighthouse factories. These links help ensure that Türkiye's industry does not merely follow standards but learns from the frontiers of twin transition and adapts best practices to local realities.

Despite a challenging global context, our focus remains consistent: to enable companies to act decisively, build lasting capabilities, and compete in a rapidly shifting industrial landscape. I hope this report serves as an actionable reference for leaders across industry, technology, and policy, supporting the next wave of industrial transformation in Türkiye.

Foreword



Semih Özkan

Executive Director, MEXT

Industrial digital transformation does not happen in a single leap. Results consolidated from 500 SIRI assessments across sectors and company sizes show consistent evidence: successful and sustainable progress follows a step-by-step approach.

The first step is to establish a digital infrastructure that enables seamless data flow by connecting machines, systems, and people. The second step focuses on reliable data collection and governance, ensuring information is accessible, standardized, and trusted. These capabilities form the backbone of early digital maturity. With reliable data and governance in place, companies can begin embedding analytics and AI into core operational

workflows, moving from visibility to prediction and from reporting to decision support. The third step starts only after this internal maturity is established: integrating into a digital supply chain that can sense, anticipate, and respond.

This whitepaper is structured around this transformation logic and reflects MEXT's operating model that combines "measure", "prove" and "scale". MEXT's technical consultancy approach translates maturity assessments into sequenced roadmaps, with an increasing focus on identifying and integrating AI-enabled use cases, while de-risking implementation through feasibility analysis, architecture guidance, and solution selection aligned with companies' realities.

MEXT's Digital Factory, with more than 200 use cases, functions as a real manufacturing environment where companies can experience how a factory of the future operates and the value it creates. It demonstrates how state-of-the-art technologies, and increasingly AI, are deployed in real operational settings. We treat capability building as a prerequisite for successful transformation and a key enabler of scale. MEXT's structured training and hands-on up-skilling programs strengthen people's engagement and align workforce capabilities with new technologies, ensuring that AI-driven initiatives can be adopted and sustained across the organization. It is important to recognize that twin transformation does not scale in isolation; it requires an ecosystem. In this context, MEXT acts as a convening platform, bringing together technology providers, academia, financial institutions, public stakeholders, and start-ups. This integrated environment enables collaboration, faster experimentation, and repeatable deployment models across the value chain.

In the following pages, readers will find a data-backed view of Türkiye's digital maturity across industries and company sizes, explaining performance gaps between Best-in-Class and lower-performing companies. Sector-specific roadmaps outline what to build first, how to integrate safely and at scale, and how to progress from "digitally enabled" to "digitally driven" operations. The success stories are structured as implementation blueprints, enabling companies to benchmark their own journeys and move faster with fewer false starts.

Together, these findings reinforce a clear message: Successful transformation requires more than technology adoption; it demands process optimization and continuous organizational development. This marks the shift from traditional manufacturing companies to data-driven industrial enterprises. This perspective frames how the report should be interpreted.

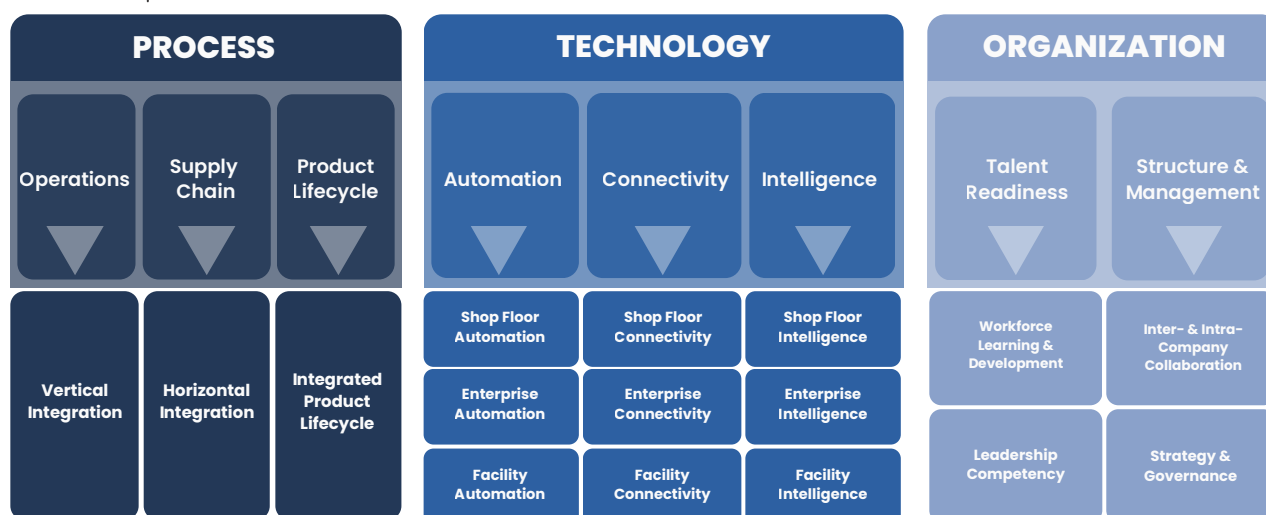
What is Smart Industry Readiness Index (SIRI)?



SIRI Methodology

In the SIRI framework, the topmost layer identifies three fundamental building blocks of digital transformation: **Process**, **Technology**, and **Organization**. The second layer underpinning the building blocks comprises eight key pillars that represent critical aspects that companies must focus on. Finally, the third layer consists of 16 dimensions, which are areas of the assessment.

Figure 1 | SIRI Framework – Building Blocks, Pillars and Dimensions



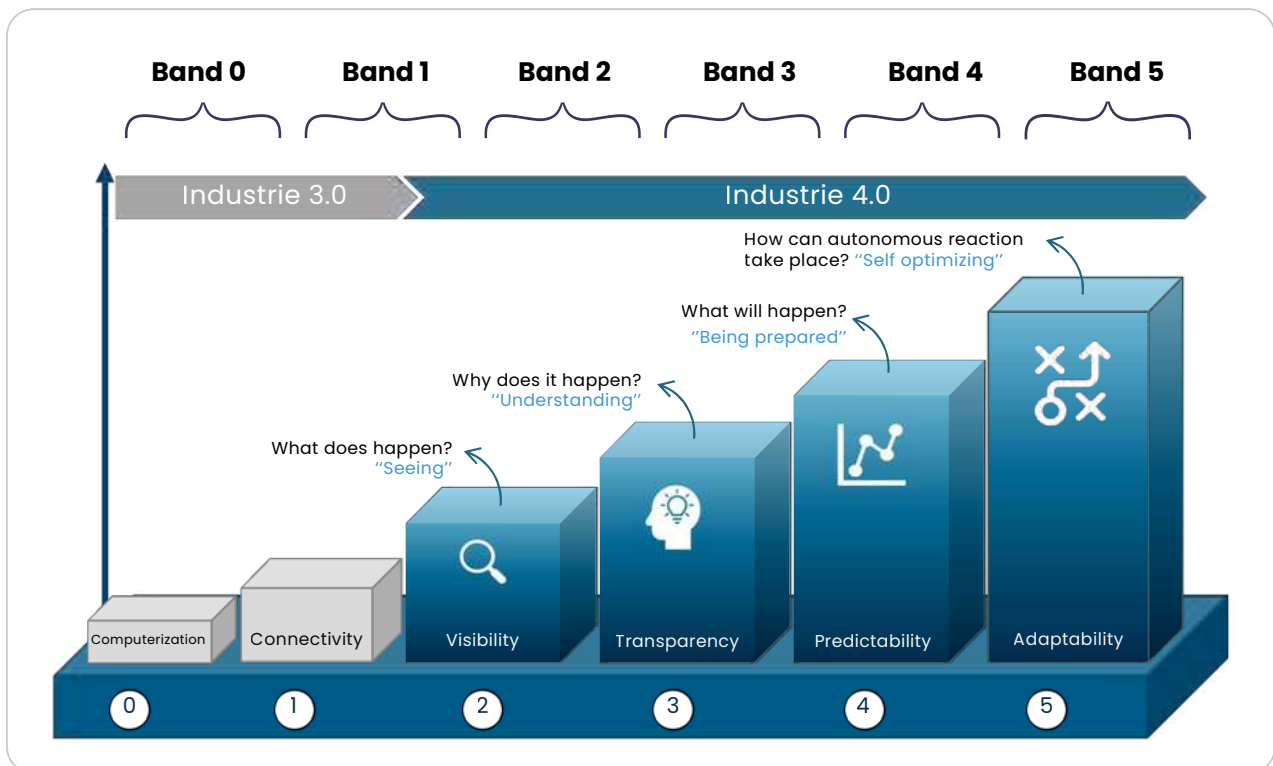
Source: International Centre for Industrial Transformation (INCIT)

SIRI's comprehensive framework enables companies to analyze their current state across 16 dimensions and conduct sector-specific and industry-wide comparisons using extensive benchmark data. Additionally, the prioritization model, which considers the company's selected KPIs, cost profile, and digital maturity gaps relative to industry best-in-class, identifies the four most critical dimensions for transformation. This approach allows companies to effectively define and implement tailored digital transformation roadmaps.

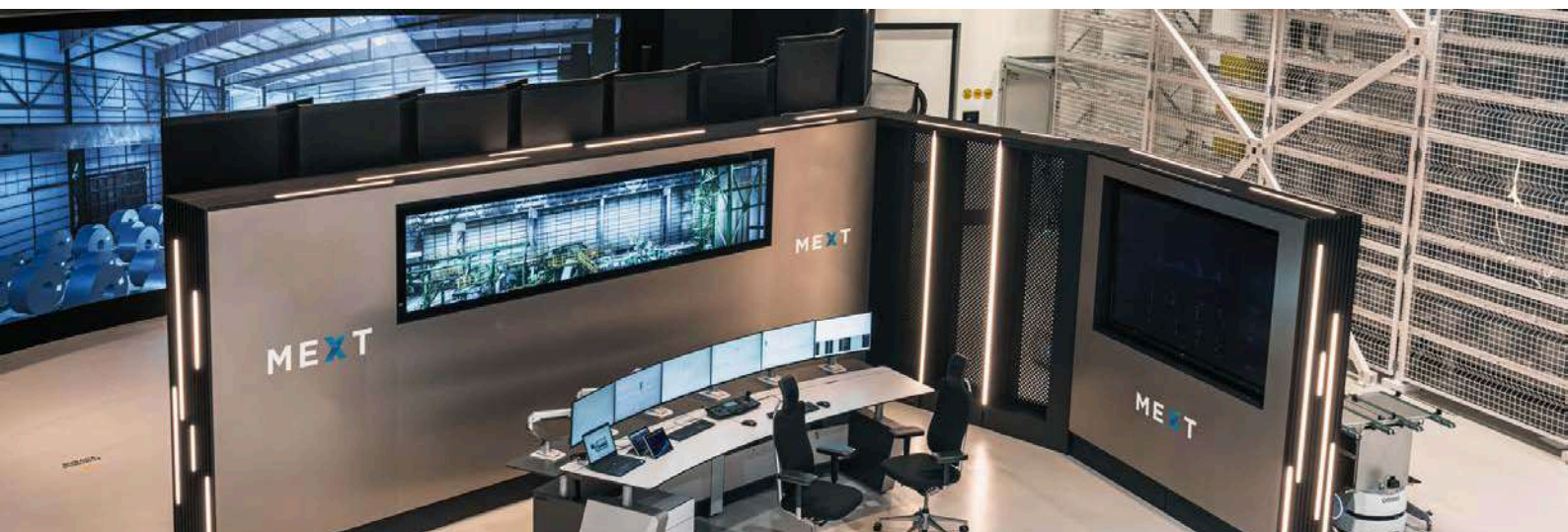
The core elements — Process, Technology, and Organization — form the foundation of this structure. The Process building block evaluates vertical integration, horizontal integration, and integrated product lifecycle across three dimensions. The Technology building block assesses automation, connectivity, and intelligence levels across shop floor, enterprise, and facility layers. The Organization building block covers workforce learning and development, inter & intra-company collaboration, leadership competency, and strategy & governance as key evaluation criteria. The digital maturity performance of a company is determined by scoring these 16 dimensions on a 0-5 band scale according to the German National Academy of Science and Engineering – Acatech Maturity Index (Figure 2).

Band 0 represents a fully manual and disconnected environment, where no digital tools are present. **Band 1** marks the transition to basic connectivity, enabling data collection with limited integration. At this level, analog tools remain dominant, but basic digital tools begin to be introduced. **Band 2** enhances visibility, allowing centralized monitoring and historical data analysis, with digital tools becoming prevalent. **Band 3** leverages advanced analytics and automation to provide transparency, helping organizations understand why processes behave in certain ways while improving integration. **Band 4** introduces predictive analytics, utilizing machine learning and AI to forecast outcomes and optimize operations. **Band 5** represents adaptive and autonomous systems, where technologies optimize processes in real-time with minimal human intervention. This structured approach enables organizations to assess their current digital maturity and strategically plan their transformation roadmap.

Figure 2 | Acatech Maturity Index

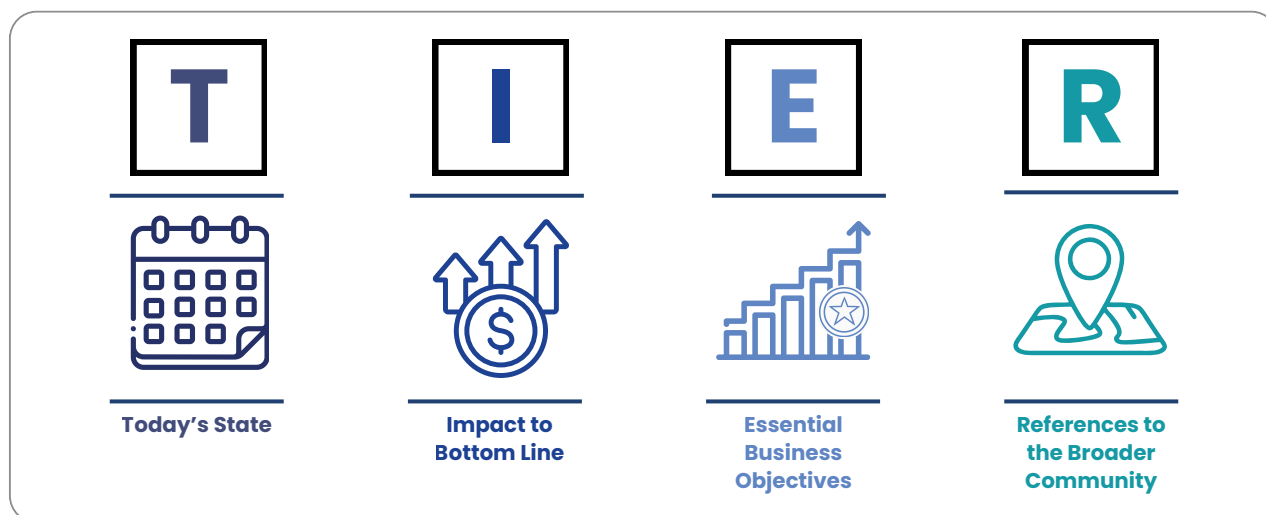


Source: Industrie 4.0 Maturity Center



Many manufacturers grasp Industry 4.0's promise but struggle to turn that knowledge into action, often due to weak strategy, limited resources, and short-term pressures. This is exactly where TIER comes in, providing a systematic prioritization framework to pinpoint the areas that create the most value.

Figure 3 | TIER Framework



Source: International Centre for Industrial Transformation (INCIT)

The TIER framework offers a high-level guide to robust prioritization built on four principles: **Today's State** (develop an impartial view of current maturity), **Impact to Bottom Line** (focus on areas with the strongest profit effect), **Essential Business Objectives** (align choices with the outcomes that matter most to the company), and **References to the Broader Community** (benchmark against peers to emulate successes and avoid pitfalls). Applied together, these principles help firms choose where to start, how to scale, and how to sustain Industry 4.0 transformation.

Important to Know

3B Benchmark:	The 3B benchmark segments performance into three bands as Bottom (10%), Broad Middle (80%), and Best-in-Class (10%) to contextualize a company's current standing against peers and guide the setting of realistic improvement targets and aspirational goals.
KPIs (Key Performance Indicators):	Quantifiable, objective metrics tied to essential business goals that measure the outcomes of Industry 4.0 initiatives and enable consistent tracking, benchmarking, and data-driven improvement across SIRI's assessment dimensions. (Detailed KPI descriptions can be found in Appendices.)
Cost Profiles:	Standardized breakdowns of a facility's cost structure (e.g., Raw Materials & Consumables, Labour, S&GA, Utilities, Depreciation) that quantify where value is spent, align with SIRI dimensions. (Detailed Cost Profile descriptions can be found in Appendices.)
Planning Horizon:	Categorizes transformation decisions by time scale: strategic (3–5 years; higher weight on KPI & Proximity, suited to MNCs without near-term pressure), tactical (1–2 years; common among SMEs for agility under uncertainty), and operational (3–6 months; greatest weight on Cost for quick financial returns).

Chapter 1 | A Record of 500 SIRI Assessments in 5 Years

This section synthesizes insights from 500 SIRI assessments conducted over the past five years to answer three critical questions: Where is Turkish industry gaining momentum, where is progress slowing and what strategic actions can accelerate nationwide industrial transformation?



The overall landscape reveals a consistent level of process discipline and standardization across the Turkish industry; however, these processes often fall short of their full potential due to the absence of robust, data-driven feedback loops. On the technology front, the most critical sequence – connectivity, data acquisition, and analytics – remains insufficiently developed, limiting scalable value creation. Organizational size emerges as a key differentiator in performance, affecting both the depth and durability of digital investments. Regional and corporate disparities are also evident: while the Marmara Region and multinational corporations (MNCs) demonstrate strong traction, SMEs continue to lag behind. Moreover, the prevailing tactical orientation of the planning horizon constraints priorities to short-term gains, hindering long-term capability building. Addressing these challenges requires deploying field-ready, connectivity-centric solutions that generate rapid and tangible benefits, promoting standards that enhance supplier-customer integration, and expanding continuous learning initiatives to elevate the digital competencies of the workforce.

General Findings: Process



- Although vertical processes are defined and standardized, ERP-shopfloor integration remains fragmented; data exchange is not automated and relies on manual transfers.
- SRM/EDI infrastructures are largely underdeveloped in the SME-heavy supplier ecosystem, resulting in limited traceability.
- PLM adoption is low; CAD – ERP – MES interoperability is ineffective. Design revisions, engineering changes and customer feedback are not reflected in the product lifecycle.

General Findings: Technology



The machine park is heterogeneous, isolated islands of automation limit standardization and hinder end-to-end operational workflows.

Auxiliary systems - energy, HVAC, compressors - show low automation maturity. Existing SCADA/BMS setups are rarely integrated with Level-3 and Level-4 systems.

ERP-based automation is limited in non-financial processes; many workflows are still carried out manually.

IoT-enabled machines are still rare, and retrofit efforts remain modest. Data arrives late and incomplete, blocking real-time OEE tracking and predictive maintenance.

Energy, water, and air metrics are mostly captured manually. Centralized monitoring is missing, optimization is limited, and anomalies are noticed only after the fact.

ERP adoption is widespread, but integration with CRM, SRM, and HRMS remains shallow. Data stays siloed, preventing the creation of a reliable single source of truth.

Root cause analytics and predictive solutions are uncommon. Data stays within SCADA systems and is not transferred to business intelligence platforms.

Energy and sustainability data is still gathered manually, and analytical dashboards are rare. This widens the gap with global sustainability expectations.

General Findings: Organization



Senior management defines the vision, but diffusion to middle management and the shop floor is weak. Digitalisation is still often viewed as an "IT project."

Digitalisation appears in strategic plans, yet KPI alignment and governance mechanisms remain limited. Projects run in isolation, and synergy across initiatives is low.

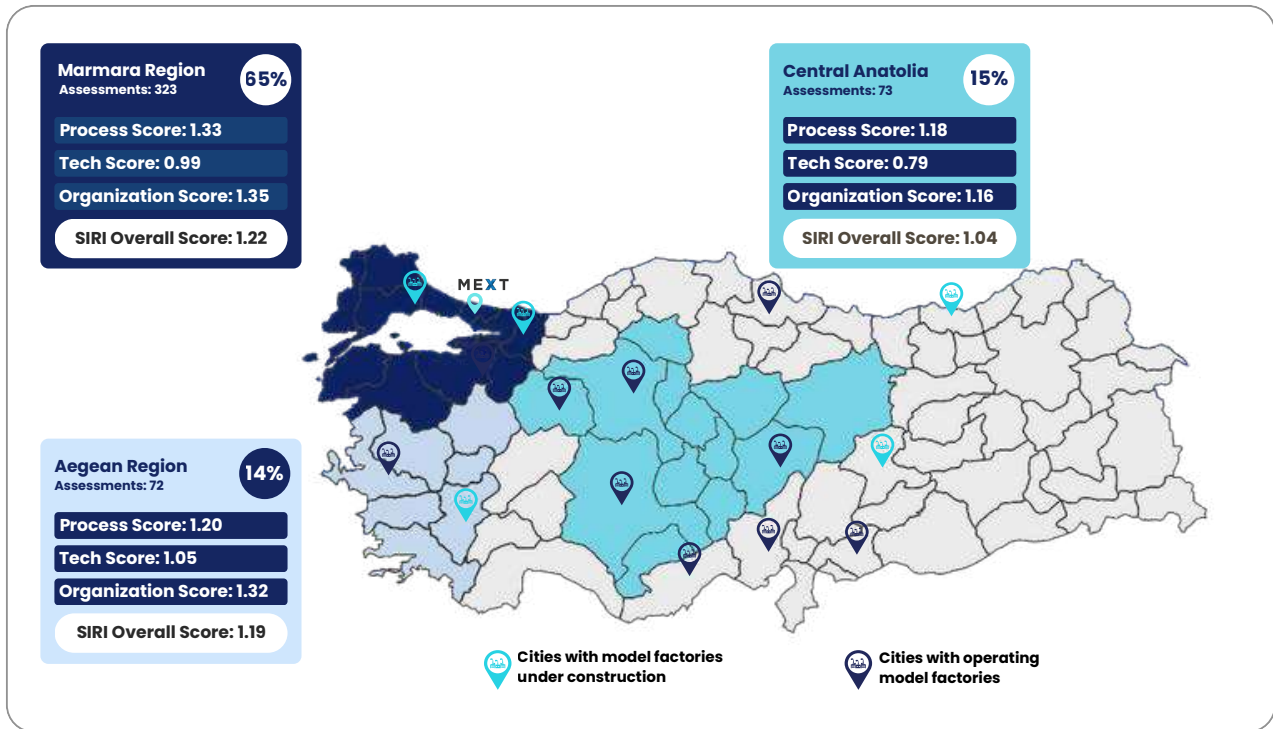
Siloed departmental structures persist, and supplier-customer relationships remain largely contract-driven. Data exchange platforms are minimal.

Training programs are typically one-off, and continuous learning culture is weak. Low digital literacy slows adaptation to new systems and tools.

1.1. Türkiye Digital Maturity Performances By Regions

SIRI assessments are conducted most intensively in the Marmara, Central Anatolia, and Aegean regions. This concentration reflects their high industrial density, the presence of organized industrial zones, and the broader diversity of companies operating in these areas.

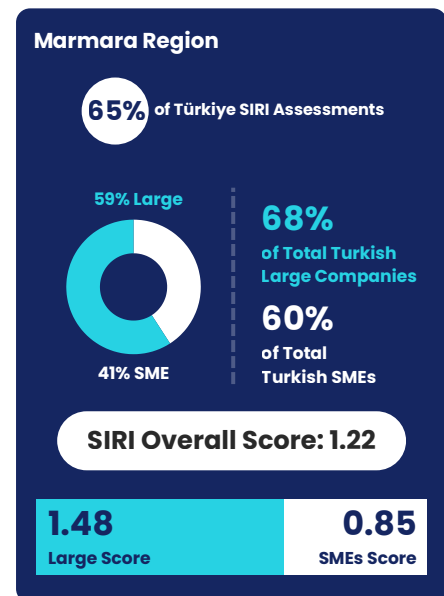
Figure 4 | Regional Overview of Türkiye's Current Digital Maturity



Marmara Region

Marmara is Türkiye's industrial core, home to high-volume sectors such as automotive, white goods, chemicals, and metals. The region's Process Building Block scores are above the national average, reflecting the early establishment of governance structures and process standards by large-scale enterprises. Enterprise Connectivity is close to Band 2 and remains above the Türkiye average, yet connectivity at the production site and facility levels is significantly lower. Data integration is stronger at the corporate layer, while operational layers lag behind. These plants have long relied on mechanical and electromechanical infrastructures, with IoT sensors, smart equipment, and modern data-collection devices introduced only in a limited way. PLC-based local solutions still dominate over sensor-rich architectures and edge devices. Because most data is collected offline or manually, the region faces barriers to adopting real-time monitoring and predictive applications at scale.

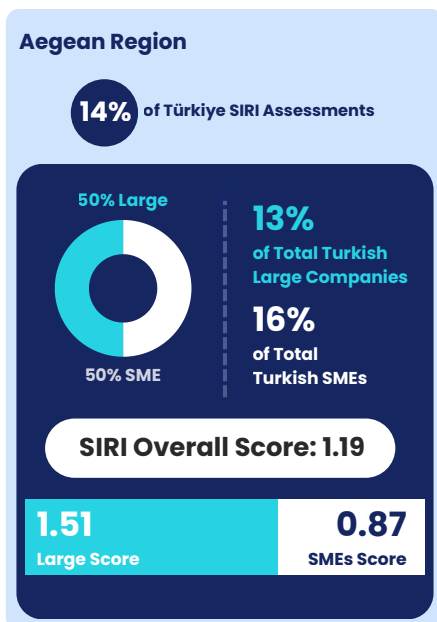
Figure 5 | Marmara Dashboard



Marmara's industrial landscape reflects a "top-down" digitalisation pattern: corporate-level process integration is relatively strong, while digitalisation at the production line and plant levels remains weaker. This imbalance results in data-driven decision-making being more effective at headquarters and far more limited on the shop floor.

Aegean Region

Figure 6 | Aegean Dashboard

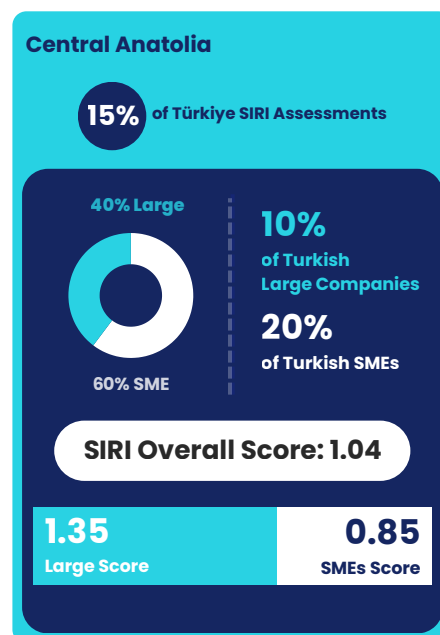


The Aegean region plays a key role in supply chain integration thanks to its free zones and export-oriented industries. However, the Horizontal Integration score remains below expectations, primarily due to the region's high SME concentration and the limited digital maturity of supplier networks. In contrast, Automation and especially Connectivity scores exceed the national average, reflecting the relatively newer production infrastructure in the Aegean compared with the Marmara region. Organizationally, the region performs strongly: Leadership Competence and Strategy & Governance scores are well above the Türkiye average. This suggests that exporting companies place greater emphasis on strategic planning and managerial capabilities to stay competitive in foreign markets. Yet the lower Workforce Learning & Development score indicates that the alignment between corporate vision and human capital development is still incomplete.

Central Anatolia

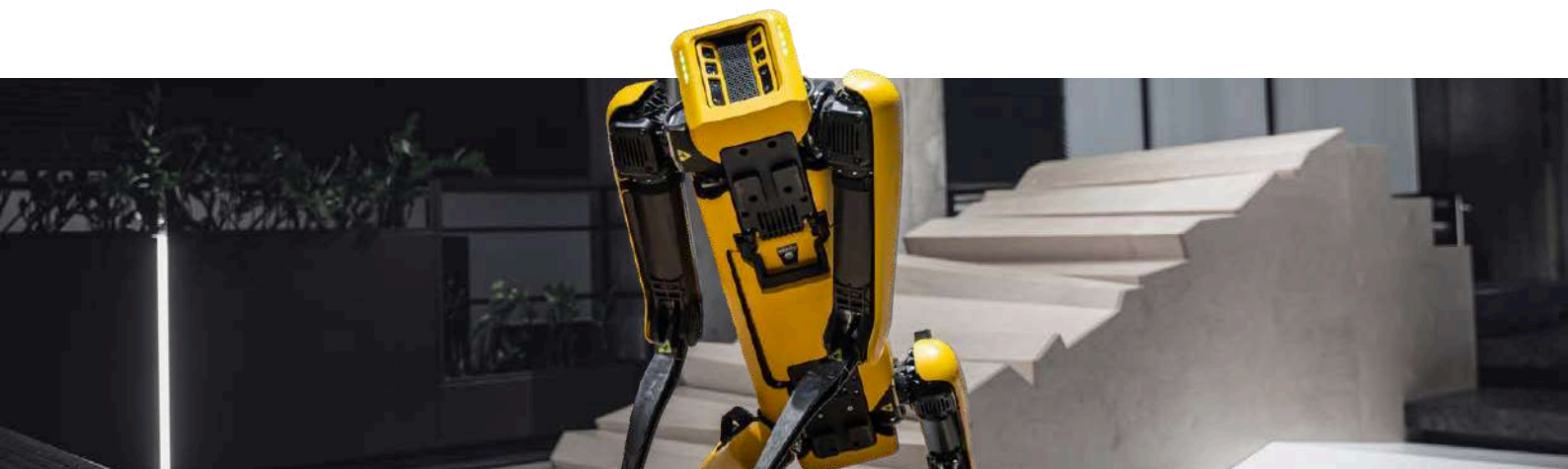
Central Anatolia's industrial profile is largely shaped by the defense, machinery, and heavy manufacturing sectors. While the region hosts several large-scale enterprises, SMEs make up a significant share of total industrial activity. This structure is directly reflected in digital maturity scores: major companies perform strongly in process and organizational areas due to investments in defense and machinery, whereas SME-level gaps in technology adoption and workforce capability pull the regional average down. Within the Organizational building block, the Strategy & Governance score is close to the Türkiye average but falls behind Marmara and the Aegean. This shows that digital transformation efforts in the region remain largely project-based, with long-term roadmaps still not fully established. The low Workforce Learning & Development score highlights the limited availability of programs aimed at building digital skills. Model Factories in the region therefore, play a pivotal role. By supporting SMEs with practical projects in automation, connectivity, and workforce development, they help create a bottom-up transformation momentum that can significantly accelerate the region's digitalization capacity.

Figure 7 | Central Anatolia Dashboard



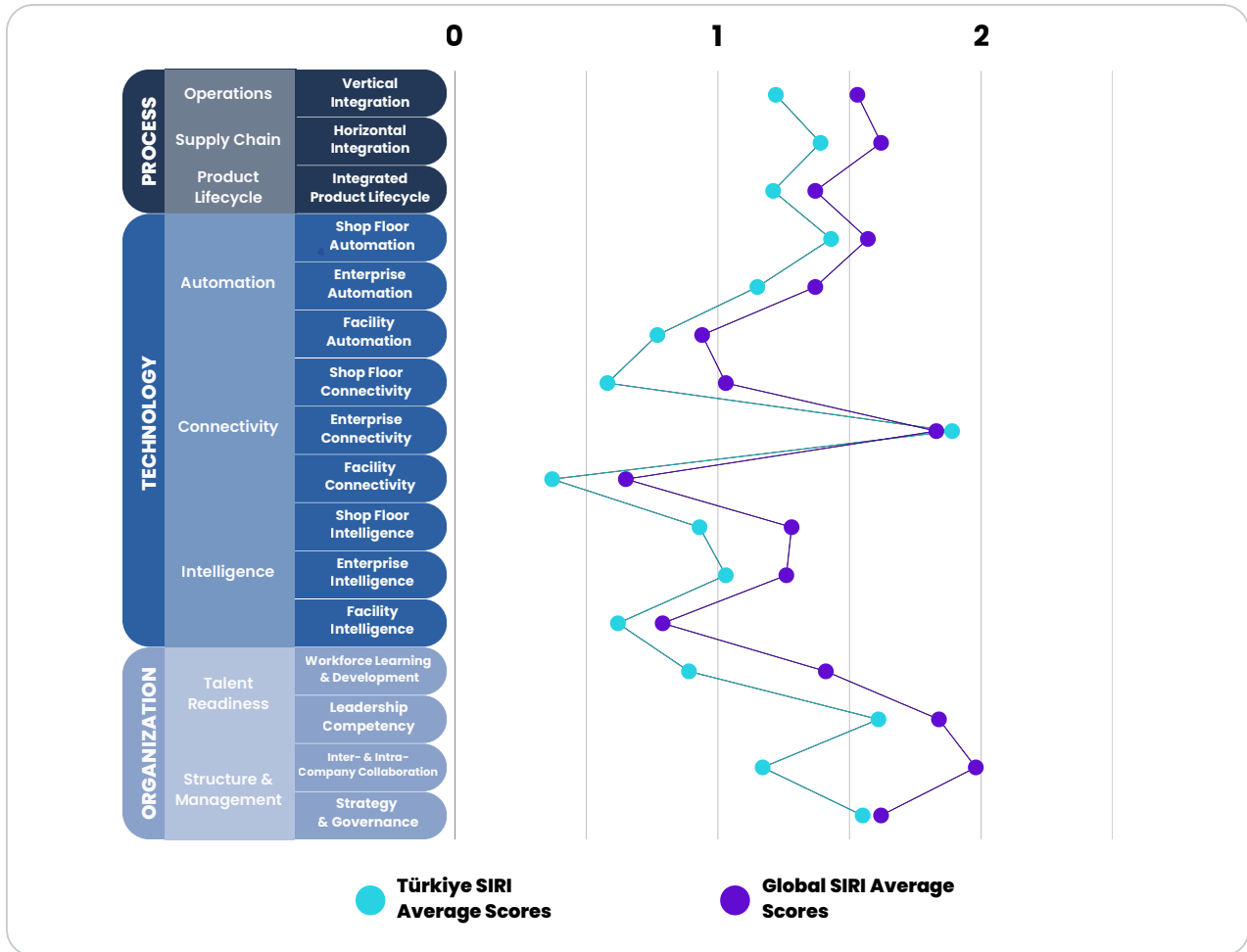
As a Summary:

- The Marmara, Aegean, and Central Anatolia regions – Türkiye’s industrial engine – show distinct digital maturity profiles. Regional industrial density shapes both the volume of SIRI assessments and the weight of their scores.
 - Marmara accounts for a large share of SIRI assessments and has the greatest impact on the national average. With its high industrial concentration and strong base of large-scale companies, the region performs well in process integration and organizational dimensions. However, weak shop-floor and facility connectivity creates a pattern of strong digitalization at the enterprise level but limited depth on the production floor.
 - Aegean stands out in connectivity metrics, supported by its export-oriented structure and relatively modern production infrastructure. Its leadership and strategy scores are also high. Yet horizontal integration remains below Industry 4.0 expectations due to the region’s SME-heavy structure and the limited digitalization of supplier networks.
 - Central Anatolia, on the other hand, benefits from the presence of defense and machinery industries, which strengthen process integration. Still, the region lags in technology building blocks and workforce development. Large enterprises demonstrate strong strategy and leadership capabilities, but overall maturity is constrained by SME-level technology and skills gaps.
- Overall average maturity scores of SMEs are nearly identical (0.85 – 0.87). This shows that SME digitalization levels remain uniformly low across Türkiye, independent of regional context.
 - Central Anatolia’s score falls below the overall average, largely due to its SME-heavy industrial structure. Targeted development programs will be critical for the region, and the high concentration of SMEs explains why Model Factories have been prioritized and implemented predominantly here.
 - Weak IoT infrastructure is a common barrier across all regions, and strengthening this layer will be the fastest lever for improving Türkiye’s overall digital maturity. Targeted projects in connectivity, sensing, and data collection can create a rapid, system-wide impact.
 - Low band scores in the Workforce Learning & Development dimension show that digitalization investments have not yet been matched by equivalent progress in human capability. In Central Anatolia in particular, workforce-focused programs will be essential to ensure sustainable transformation.



1.2. Mapping Türkiye's Digital Maturity on the Global Stage

Figure 8 Türkiye & Global Average SIRI Dimensions Comparison



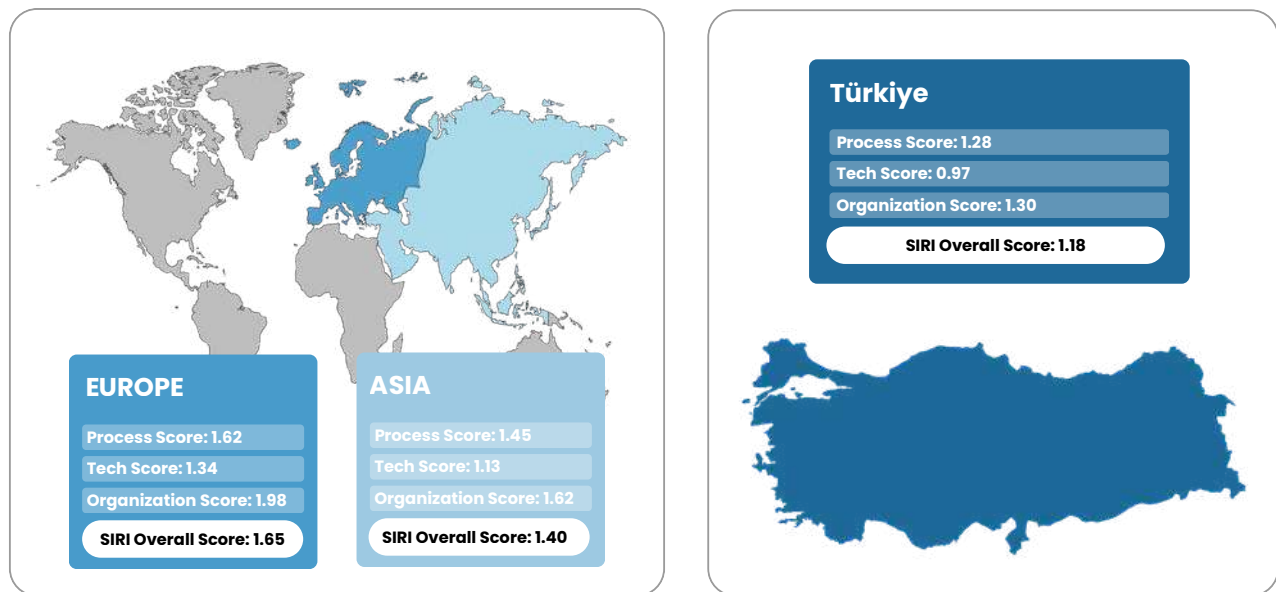
Global Source: INCIT

Although Türkiye's digitalization profile generally remains below the global average, most of the differences do not reach critical levels. This situation shows that strong points are not entirely absent, but that systematic improvement is needed in many areas. In particular, the density of SMEs, outdated production infrastructure, and limited integration solutions have been key factors shaping Türkiye's overall picture. Therefore, the picture indicates that digitalization has not been spread across the board, but at the same time, there is a significant desire for transformation in certain industries and at the top management level.

The areas where Türkiye is most limited are the integration of vertical processes, particularly the level of connectivity at the production and facility level, and the creation of analytical capacity. The lack of widespread real-time data collection, sensorization, and automation solutions limits efficiency and predictive management capabilities. Similarly, deficiencies in developing digital competencies across the organization and limited collaboration make it difficult to translate digital transformation goals into operational reality.

When compared to the scores of the continents where Turkey is located, the results show that Turkey lags behind Asia in process, technology, and organization scores, and is significantly below Europe. Overall, there is a difference of approximately 0.22 points between Türkiye and Asia, and 0.47 points between Türkiye and Europe. The largest gap is in organization block, followed by technology and process blocks. The map suggests that operational moves will be decisive in approaching the Asia average in the short term, while deepening management, governance, and institutional capacity will be decisive in reaching the Europe level.

Figure 9 | Continental Analysis: Comparison with Asia and Europe



Global Source: INCIT

Process: Close to Asia, far from Europe

Turkey's process maturity is relatively close to Asia but distinctly far from Europe. This position indicates that the cornerstones of the production system are in place, but there are gaps in standardization, consistency, and end-to-end synchronization. In other words, Turkey is limited in meeting European-style customer expectations that demand low variance and high predictability. This picture on the process side is often based on two structural reasons. The first is the disjointed work of the planning layers: when the sales and operations plan, the master production plan, capacity constraints, and the workshop schedule do not converge in a single "master plan," a discrepancy arises between the field reality and the MRP outputs. The second is insufficiently consistent standard work and variability control: When SMED/disciplined product changeover, process capabilities, quality gates, and WIP limits are not applied consistently, performance fluctuations increase and delivery reliability decreases.



Technology: Visibility and integration gaps limit competitiveness

The technology score lags one step behind Asia and several steps behind Europe. This points to a fragmented picture in terms of collecting data from the field and ensuring systems feed into each other seamlessly. Limited visibility directly impacts delivery reliability, quality costs, and traceability requirements. Considering the increasing reporting/compliance expectations in the European market, this technology gap suppresses non-price competitiveness. In the short term, increasing visibility with “light” solutions; in the medium term, standardizing data and integration is the most rational path.



Organization: The real difference maker

The biggest gap is in organization. Europe's clear superiority demonstrates the weight of leadership rhythms, strategy-governance, project portfolio discipline, and cross-team alignment in competitive strength. When these muscles are not sufficiently strong in Turkey, the impact of technology/process investments can be scattered; coordinating multi-site structures, supplier development programs, and benefit tracking become difficult. Operational moves may be enough to approach Asia; improving management quality is essential to climb to Europe.

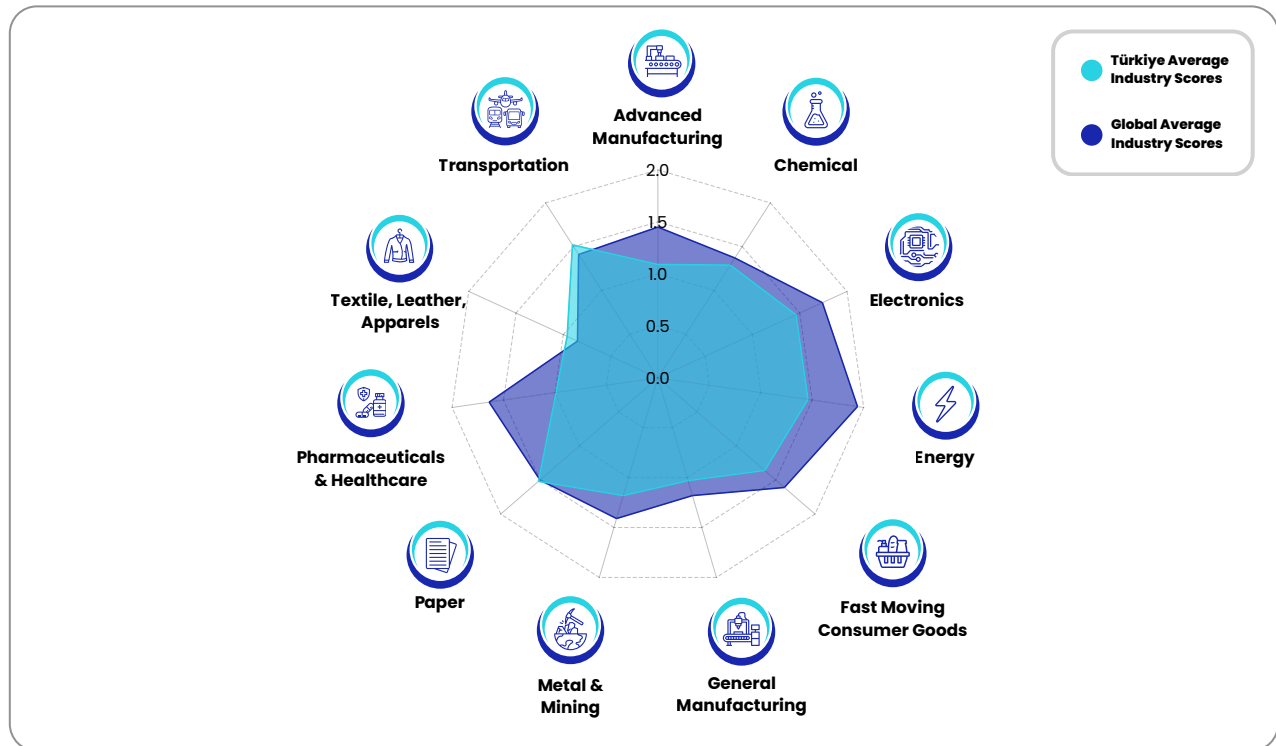
Roadmap: Asia threshold, Europe benchmark

Short term – approaching the Asia threshold: Prioritize process discipline (S&OP/IBP), a single integrated plan, real-time data at critical stations, and improved visibility. These actions rapidly enhance delivery reliability and unit cost performance. Medium term – progressing toward the European benchmark: Strengthen corporate capabilities through a structured PMO with KPI tracking, robust data governance, multi-facility standards, supplier development frameworks, and end-to-end traceability. Developing these capabilities will allow Türkiye to build a sustainable competitive advantage anchored in speed, reliability and compliance. In contrast, Türkiye shows a relatively stronger profile in areas such as strategic ownership, leadership-level vision setting, and enterprise connectivity. The solid commitment to transformation among senior management – especially within large scale companies – reflects the country's potential to close the gap over time. The key question is how effectively this vision can be translated to the shop floor, the workforce, and the underlying technological infrastructure. If facility-level investments accelerate and employee digital skills are strengthened, Türkiye can not only close its current gaps but also gain rapid momentum in several areas.

1.3. Industry Performance: Türkiye vs Global Benchmarks

Comparing Turkish industries with global averages reveals which industries have a relative advantage in digitalization and which are lagging behind, helping to identify priority areas for transformation across the country.

Figure 10 | Industry Based SIRI Overall Score Comparison



Global Source: INCIT

Above Global Average / Close to Parity

Transportation: Türkiye's transportation industry demonstrates maturity levels above the global average, driven primarily by the Marmara-based OEM and Tier 1 cluster. Major manufacturers in this region have long embedded lean production practices and structured supplier development programs. In addition, the stringent quality and traceability demands of export markets have accelerated the adoption of systems such as ERP and MES, strengthening production tracking, process transparency, and operational efficiency. Türkiye's above-average performance is therefore largely shaped by the automotive-centered concentration of high-maturity firms. However, this picture does not fully extend to the SME supplier base. Companies producing rubber and plastic parts, simple castings, brake components, and similar inputs display significantly lower maturity levels, creating a clear gap within the overall average. This gap reveals that the industry's strength is anchored in the leadership of OEMs and large Tier 1 players rather than a uniformly developed ecosystem. Without improvements, especially among SMEs, the widening disparity between the top and the base may limit the long-term competitive strength of the sector.





Paper: For SMEs, low digital maturity observed in cleaning paper product manufacturing, printing, and labeling indicates heavy dependence on manual processes and traditional production methods. Limited productivity investments, especially in energy-intensive standard product manufacturing, further depress maturity levels. For the non-SME group, in contrast, the relatively higher maturity indicates stronger digital adoption in more industrial and technology-oriented segments, such as packaging film production and large-scale hygiene products. These companies tend to use more advanced automation, quality control systems, and supply chain integration, raising the overall industry average. As a result, scale emerges as a decisive factor in the digital maturity of Türkiye's paper industry. SMEs continue to operate with manual processes and limited IT/OT convergence, while large companies are approaching global benchmark levels through investments in process control and automation.

Textile/Leather/Apparel: Türkiye's textile, leather, and apparel industry shows maturity levels above the global average. This is more evident among denim, yarn-fiber, wool, and ready-to-wear exporters, where quality management, process discipline, and compliance with customer standards are well established. Niche segments such as home textiles, socks, and accessories are also adapting more quickly to digitalization due to rising quality expectations in export markets. In contrast, more traditional operations such as fabric dyeing and finishing remain constrained by outdated machinery and low automation maturity. While the industry's labor-intensive structure affects companies of all sizes, long-term competitiveness will depend on segment-specific machine modernization and broader adoption of digital supply chain systems. Priorities include accelerating automation in dyeing and finishing processes and expanding ERP-PLM use among SME-scale ready-to-wear manufacturers.



Close to Parity but Lagging Behind

Chemical: Thanks to long-standing ERP, automation, and integration investments by large-scale companies, Türkiye's maturity level in this area sits above the national average and close to the global average. With continued progress in infrastructure, sustainability-focused digital solutions, and advanced analytics, the industry holds strong potential to turn this position into a global competitive advantage. While Türkiye is near global parity in continuous, capital-intensive chemical production, SME-heavy segments remain fragmented due to limited machine connectivity, uneven MES/PLM adoption, and a weak data-driven operating model. Closing this gap is less about large scale infrastructure spend and more about scaling standard connectivity, lightweight MES deployments, and practical operational analytics. Companies that turn production data into real time transparency, predictive process control, and cross functional integration will shift from "digitally enabled" to "digitally driven" operations strengthening competitiveness across regional and global value chains.



General Manufacturing: Türkiye's General Manufacturing industry trails the global average by a small margin, largely due to its heterogeneous structure. Globally, maturity is driven by highly automated continuous processes, widespread machine connectivity through SCADA and MES, standardized quality systems, and strong supplier-customer integration. In Türkiye, however, a larger share of small, workshop-type, make-to-order companies creates structural gaps. Legacy equipment and PLC systems with no to limited connectivity, manual workflows, and a lack of data-driven quality and maintenance contribute to the difference. Areas with continuous processes and high-capacity lines - such as cement, ceramics, steel, packaging, and cable - are closer to global standards. By contrast, job-shop segments, including metalworking, plastic injection, special-purpose machinery, and structural components, pull the overall average down. The fastest way to close this gap is to take low-cost yet impactful actions among SMEs, such as machine connectivity and OEE tracking, material flow monitoring with barcodes or RFID, digital quality and maintenance management, and lightweight manufacturing information/execution systems (MIS/MES). For medium-to-large companies, SCADA-MES-QMS integration, advanced process control, predictive maintenance, and horizontal integration via supplier portals or EDI are essential.



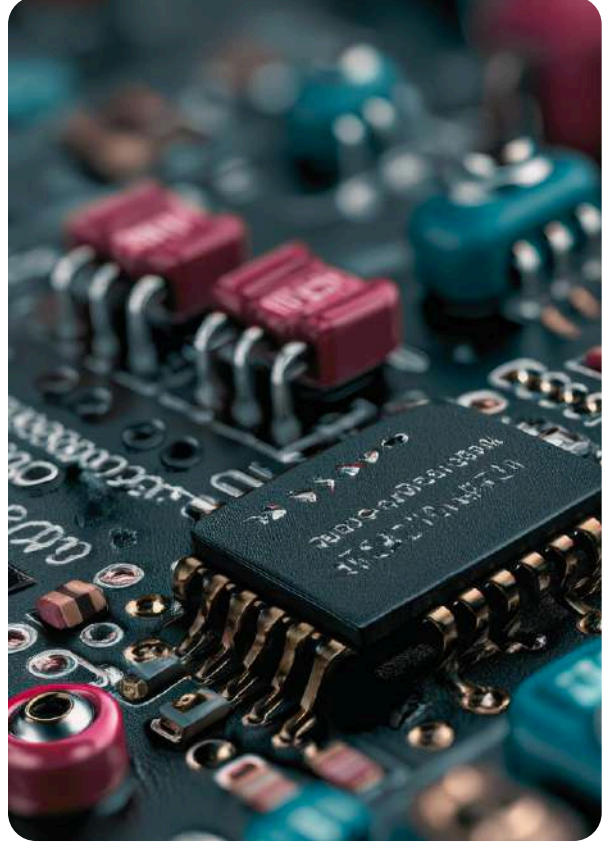
Substantially Lagging Industries in Türkiye Compared to the Global Average

Pharmaceutical & Healthcare: Türkiye's significant gap relative to global benchmarks is uneven and largely driven by a structural split between pharmaceutical manufacturers and medical device/consumables producers. Large pharmaceutical producers tend to show stronger maturity in Shop Floor Automation, Vertical Integration, and Structure & Management, reinforced by GMP discipline, validation requirements, and exposure to global compliance expectations. By contrast, medical device and consumables manufacturers, representing more than half of the assessed sample, often plateau at basic ERP usage, with weak end-to-end integration across operations, quality, and planning. This creates a two-speed transformation profile. Pharmaceutical players are steadily progressing toward integrated execution, batch traceability, and tighter data governance within controlled production environments. Meanwhile, much of the medical device and consumables segment remains constrained by fragmented systems, manual documentation, and limited use of analytics. The outcome is clear: progress is visible where compliance-driven operating models force integration, but sector-wide maturity is held back by structural bottlenecks in connectivity, quality digitization, and enterprise-level intelligence.



Energy: The key factor shaping Türkiye's average score in the energy industry, which lags behind the global level, is the low performance of companies producing energy equipment and services. Digitalization remains limited in product groups such as generators, fixtures, and valves. Although higher scores appear in core energy domains - oil, gas, and renewable fuel production - this strength is diluted in the overall average due to the low performance of equipment manufacturers. For many years, priorities in Türkiye's energy sector have centered on supply security and cost control. In the short term, physical investments such as building new transformer stations, expanding spare capacity, or securing fuel supplies may seem more tangible. However, digital solutions are equally critical in supporting these goals. Real-time monitoring, predictive maintenance, and optimization applications can enhance continuity, efficiency, and reliability. Integrating digitalization with traditional investment priorities will allow the industry to achieve stronger outcomes in both safety and cost performance.

Electronics: Major white goods and consumer electronics companies significantly lift the national average thanks to their strong production infrastructure, high automation levels, and integration into global markets. The picture is different, however, for their suppliers and EMS (Electronics Manufacturing Services) companies. These companies largely assemble externally designed products and operate with limited digital integration. Because shop-floor automation and PLM-MES integration are not sufficiently mature, the pressure created by frequent model changes is felt more intensely, and digitalization levels remain relatively low. Globally, although similar challenges exist, widespread use of design and product lifecycle management tools, combined with standardized flexible automation solutions, moves the industry to a more advanced level. The gap in Türkiye stems from the fact that while high-tech primary manufacturers show strong momentum, the EMS-focused segment has not yet achieved the same depth of digital capability.



Fast Moving Consumer Goods: Türkiye's FMCG industry lags behind the global average primarily due to limited digitalization in sub-industries focused on the domestic market, such as canned food, coffee, catering, and industrial sauces. In contrast, segments with stronger brands and export potential - dairy and meat products, confectionery and snacks, beverages, personal care, and hygiene - perform better and lift the overall average. However, distribution networks and retail data are not sufficiently integrated into the digital ecosystem. This disconnect makes it difficult to adapt production to frequent line change-overs and limits the depth of recipe management, both of which are essential for agile operations. Globally, practices such as demand forecasting, end-to-end traceability, and packaging line analytics are becoming standard, but in Türkiye, these capabilities are adopted only on a limited scale. As a result, the industry faces a competitive disadvantage, especially in areas that require speed, flexibility, and tighter synchronization between production and market dynamics.

Metal & Mining: Türkiye's Metal and Mining industry has a highly fragmented structure, spanning casting, aluminum solutions, high-grade steel, surface chemicals, precious metals, and automotive component production. Foundries and small-scale mechanical parts manufacturers - which form a large share of the sector - operate with legacy machinery, limited automation, and weak data integration. Heavy processes, aging equipment, and difficult operating conditions constrain sensorization, while the energy-intensive nature of production leads to inefficiencies without modern monitoring systems. In contrast, companies in the aluminum, steel profile, and automotive supply chains achieve higher maturity levels due to modernization investments, and regulatory pressures in precious metal production are accelerating digitalization. Although this diversity pulls Türkiye's overall average below the global benchmark, targeted modernization and data-driven monitoring investments - especially in process-intensive areas - can significantly narrow the gap.

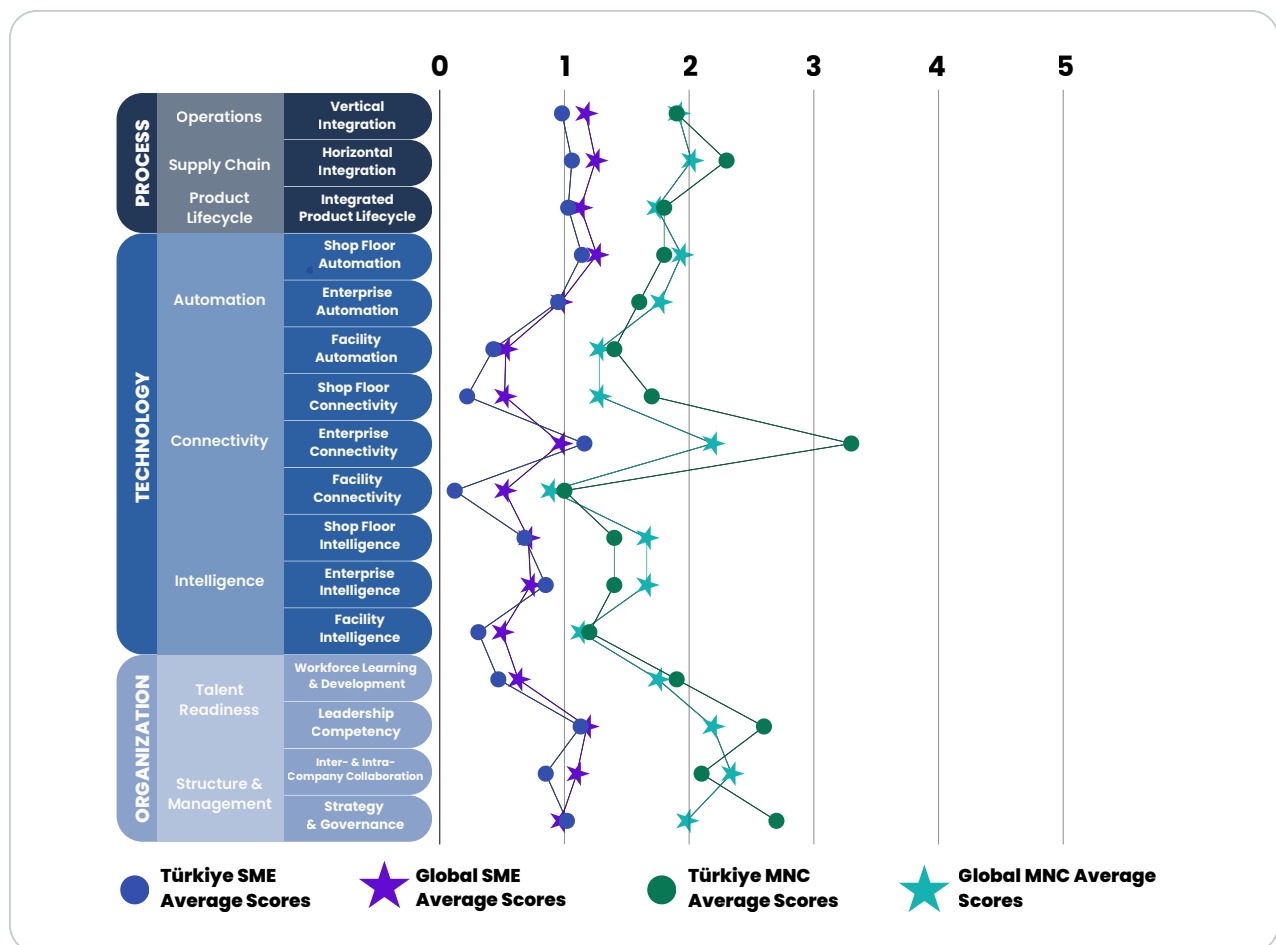


Advanced Manufacturing: Türkiye's Advanced Manufacturing landscape is shaped largely by the dominance of mechanical parts manufacturers and machine builders. Digitalization in this group remains limited, particularly in design-production integration and process optimization. In contrast, more advanced digital applications appear in technology-intensive sub-industries such as defense, aerospace, industrial automation, and climate control. This diversity stabilizes the industry average but also keeps Türkiye below the global benchmark. Globally, higher maturity levels stem from the integrated use of digital tools across product development and production - such as product lifecycle management, digital design, and process simulation - which are far more widespread. In Türkiye, the gap is widened by the limited digitalization capacity of SME-scale mechanical parts and machine manufacturers, who form a substantial portion of the sector.

1.4. Distinct Sizes, Common Goals: MNCs & SMEs

The digital maturity performance of SMEs and MNCs in Türkiye is compared with their global counterparts to provide a clearer view of the country's position. The analysis is structured in three steps: first, Turkish SMEs are benchmarked against global SMEs; then, Turkish MNCs are compared with global MNCs. Together, these comparisons highlight the specific areas where further progress is required. Although SMEs and MNCs operate within the same ecosystem, they differ significantly in scale, capital structure, access to technology investments, and integration into global networks. MNCs typically take the lead in transferring global standards and advanced technologies into the domestic market, while SMEs form the backbone of the local supply chain with flexible production capabilities. Examining the digitalization performance of both groups together provides a more accurate view of the gaps influencing the national average and highlights where knowledge and technology transfer are most needed.

Figure 11 | Türkiye & Global Comparison: SME and MNC Based Analysis



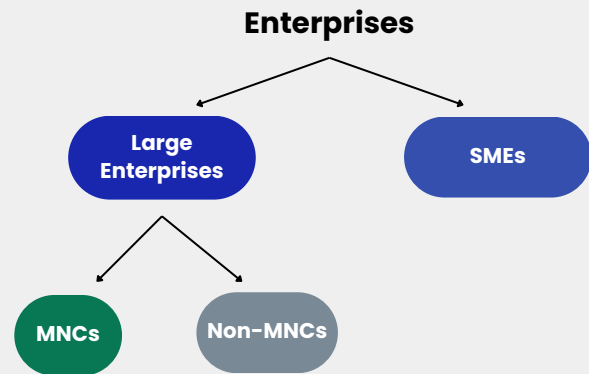
Global Source: INCIT

Although Turkish SMEs are close to their global counterparts in core processes, more pronounced gaps appear in connectivity (shop floor and facility) and inter- & intra-company collaboration. Closing these gaps is critical for achieving a significant leap in digital maturity. In contrast, a very different picture emerges when Turkish multinational companies are compared with global MNCs: Turkish MNCs outperform in many dimensions, lifting the overall national average despite the generally country-wide low maturity level.

Framework of Enterprise Segmentation

Small and Medium-Sized Enterprises (SMEs) are firms with limited workforce and turnover, as officially defined by KOSGEB, whereas Large Enterprises operate on a broader scale with greater resources and market influence. Within the Large Enterprises category, Multinational Corporations (MNCs) are those with significant cross-border operations, whereas Non-MNCs conduct their activities mainly within national boundaries. This classification will be used throughout the following sections of the report.

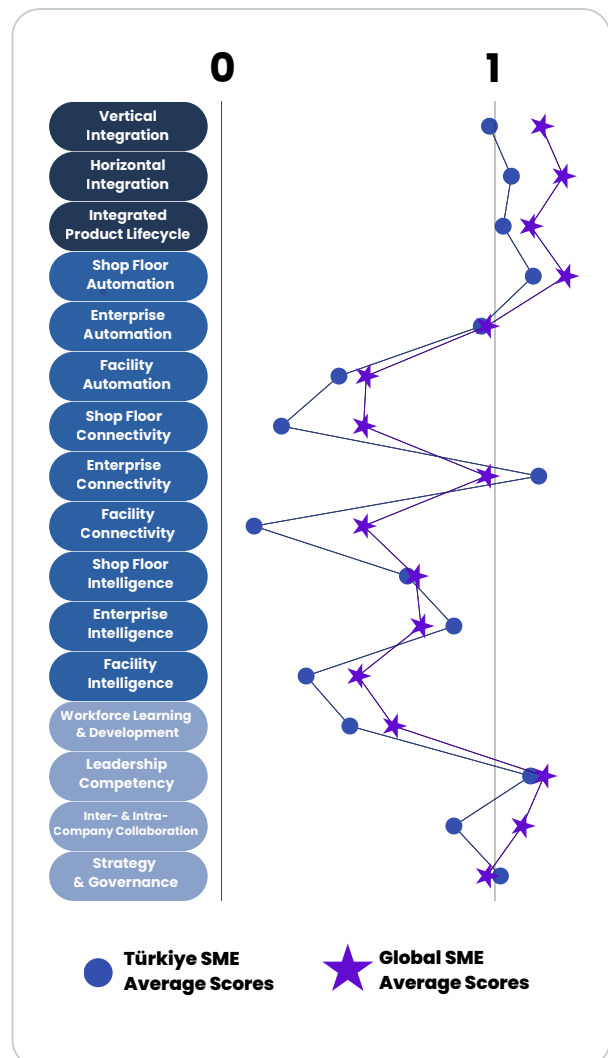
Figure 12 | Enterprise Segmentation



SME Comparison: Türkiye vs Global

Although the digital maturity of Turkish SMEs is slightly behind that of global SMEs, the differences are not substantial. In the Process Building Block, both groups have defined processes but rely heavily on analogue execution; communication typically occurs via email and phone, leaving no digital footprint. Technology maturity shows similar patterns: shop-floor and enterprise automation levels are comparable, while facility automation remains very low on both sides. This stems from a long-standing focus on production line investments rather than digitizing facility infrastructure. Connectivity is where Türkiye lags more visibly. Shop-floor Connectivity is lower than global averages, and the gap widens significantly at the facility layer; machine-to-machine and facility-level network integration remain well below global standards. In contrast, Turkish SMEs perform relatively better in the Enterprise Connectivity dimension. Existing ERP and basic IT applications connected to a common network keep the average at Band 1. However, limited data sharing, manual data entry, and the absence of real-time integration prevent progress toward Band 2. Intelligence dimensions remain the weakest area globally and in Türkiye. The limited use of data analytics and artificial intelligence keeps performance firmly below Band 1. Organizationally, the structures are broadly similar, but Türkiye's lower score in Workforce Learning & Development stands out as a critical barrier to sustaining digital transformation over the long term.

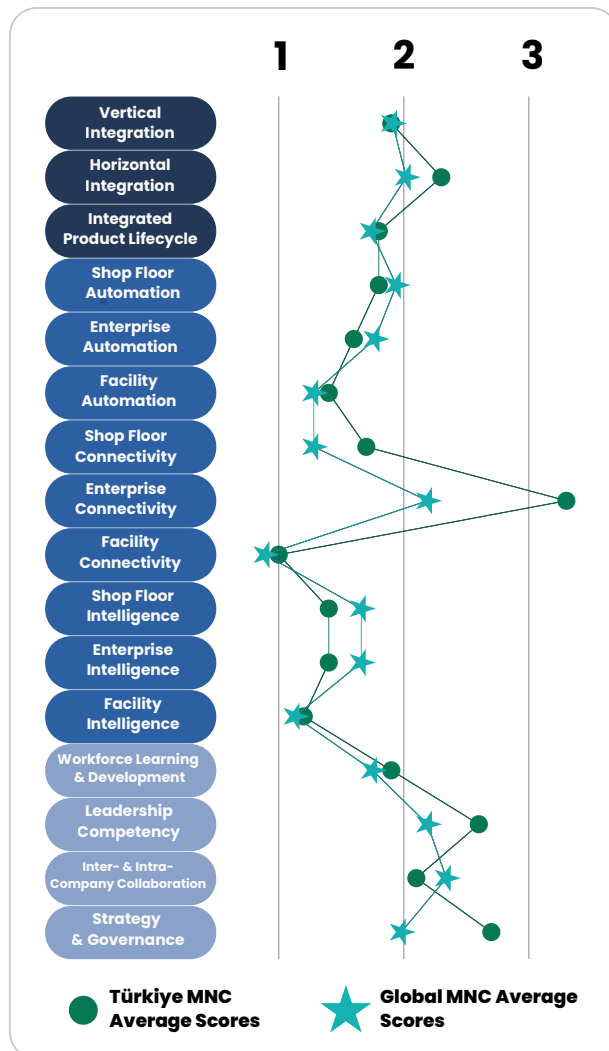
Figure 13 | Comparing Türkiye & Global SMEs



Global Source: INCIT

MNC Comparison: Türkiye vs Global

Figure 14 | Comparing Türkiye & Global MNCs



Global Source: INCIT

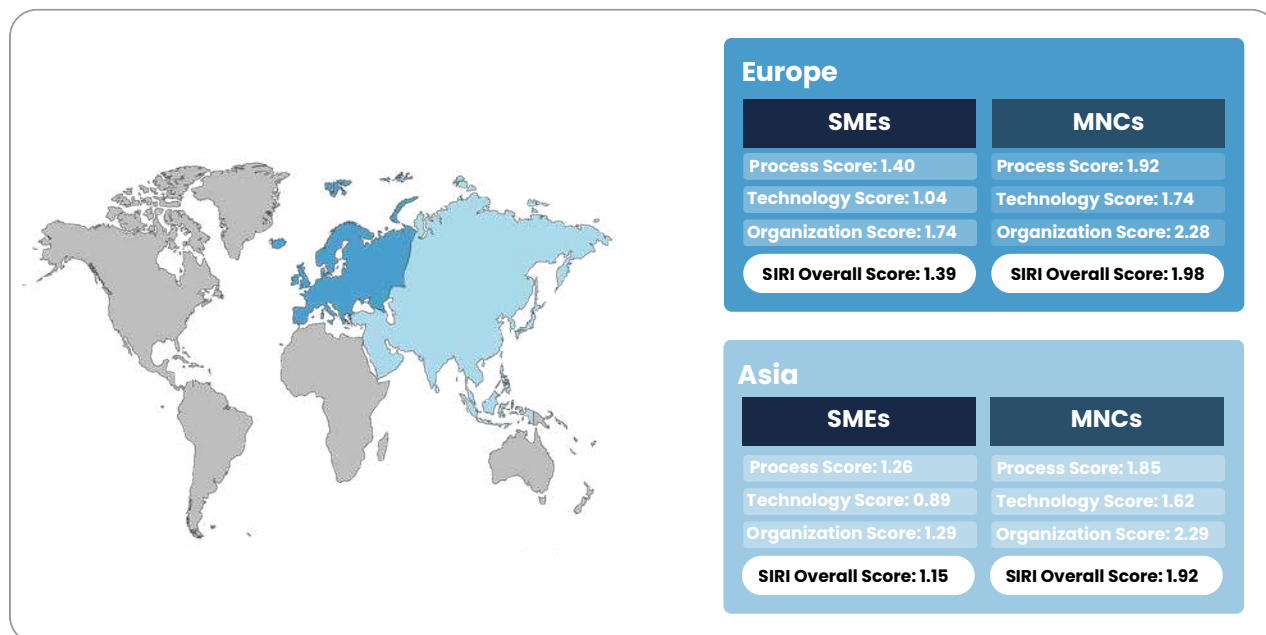
In contrast, the areas where global MNCs lead are mostly concentrated in automation and intelligence. Although the difference in Shop Floor and Enterprise Automation dimensions is not significant, global MNCs are seen to focus more on advanced automation investments. Global companies are also relatively ahead in intelligence dimensions: although Turkish MNCs surpass Band 1 in data collection, they are slower to translate this data into analytics and artificial intelligence applications. In addition, global MNCs show stronger performance in inter- and intra-company collaboration, supported by more institutionalized project-based communication structures and collaboration platforms. The fact that Turkish MNCs lag behind in Shop-floor and Enterprise Intelligence dimensions indicates that their data collection and processing capabilities remain limited despite strong integration. The use of analytics and AI is not yet systematic, suggesting that Türkiye's strengths in connectivity have not fully evolved into robust, data-driven decision-making mechanisms.

These differences indicate that SME programs in Türkiye should prioritize connectivity and collaboration, while MNCs should focus more on analytics and intelligence solutions. Addressing both fronts in parallel will help establish a more balanced digital maturity profile at the national level.

MNCs in Türkiye generally outperform their global counterparts and show higher maturity across seven dimensions. This stands in stark contrast to the pattern observed among SMEs, where Turkish companies typically lag behind global peers. In other words, Türkiye may trail at the SME level but takes the lead at the MNC level, underscoring the impact of scale, capital strength, and the disciplines that come with global integration.

Notably, Turkish MNCs reach or exceed Band 2 in more dimensions, presenting a relatively strong global position. The advantages of Turkish MNCs are most pronounced in the Connectivity and Organization dimensions. On the Enterprise Connectivity side, the more widespread use of security measures creates a clear edge. Enterprise systems such as ERP, MRP, and WMS are not only interconnected but are also supported by cybersecurity protocols. Türkiye also performs strongly in Shop-floor Connectivity, indicating more integrated data flow between machines and systems. Leadership and Strategy scores favor Türkiye as well. This advantage is driven by the rapid adaptation of global headquarters' visions to local operations, allowing strategic priorities to be executed with greater clarity and ownership in the field. This alignment provides Turkish MNCs with a distinct competitive advantage in global comparison.

Figure 15 Türkiye vs Asia & Europe Comparison: SME and MNC Based Analysis



Global Source: INCIT



Intercontinental Performance: Türkiye's Position in the SME–MNC Classification

SMEs: Europe Ahead of Asia — Driven by Management and Coordination Strength

European SMEs outperform Asian SMEs primarily due to stronger organizational capabilities. Regular decision-making rhythms, disciplined project portfolio management, cross-functional coordination, and more structured supplier management create a clear advantage. The technology gap is smaller but consistent, while the process difference stems from Europe's ability to apply the same standards with the same consistency across all facilities. This structure makes European SMEs preferable in work requiring high reliability, whereas Asian SMEs remain competitive for flexible, cost-sensitive production.

MNCs: Continents Closer Together — Europe Leads in Production and Technology Adoption

Among MNCs, the maturity gap between continents is much smaller. However, Europe remains one step ahead due to deeper integration of production systems, more advanced automation, and broader deployment of enabling technologies.

Türkiye's Dual-Speed Position

Türkiye progresses at two very different speeds: MNCs in Türkiye are broadly on par with global standards, reflecting strong integration with international networks. However, SMEs fall significantly below the averages of both Europe and Asia, particularly in organizational and connectivity-related areas. This dual-speed dynamic highlights the need for SME-focused development programs to close the structural gap and create a more balanced national digital maturity profile.

MNC profile – an area where standards converge.

The performance of MNCs is nearly uniform across continents. The small advantage held by Europe comes from processes and technologies that operate one step more systematically. On the organizational side, Europe and Asia are almost identical, as global management models are deployed consistently across regions.

Turkey's distinctive point – two different speeds within the same country:

In Türkiye, MNCs operate at a level comparable to their European peers and even exceed them in certain dimensions under Process and Organization Building Blocks. Turkish SMEs, however, lag substantially behind European SMEs and meaningfully behind Asian SMEs. The largest gap appears in Organization Building Block followed by Technology and Process. +This reflects a profile capable of running operations but struggling to institutionalize rhythm, standards, and data integrity. As a result, two very different speeds coexist within the same supply chain and geography.

These speed differences inside the country can create weaknesses in the supply chain:

MNCs provide the desired standard, but the heterogeneity in the supplier base threatens delivery integrity. At the same time, this situation presents an opportunity: if the practices applied locally by MNCs (rhythm, standard, data) can be transferred to SMEs through mentoring, supplier development, and joint KPI mechanisms, the country average can increase quickly.

Türkiye's competitive threshold between Europe and Asia will be determined by how quickly the MNC standard can be scaled down to the SME base. As organizational muscle strengthens, technology and process investments yield faster returns; thus, Türkiye becomes a reliable supply hub in the European chain while also establishing a stronger balance of speed and adaptability in competition with Asia.

Performance of SMEs and MNCs in Türkiye

Figure 16 | Building Block Comparison on Türkiye's SMEs and MNCs

	Türkiye SME	Türkiye MNC	Gap Between MNC
Process	1.02	1.99	0.97
Technology	0.65	1.64	0.99
Organization	0.87	2.31	1.44
Overall	0.85	1.98	1.13

As it can be seen on Figure 16, SMEs in Türkiye tend to focus on operational efficiency and sustaining day-to-day activities, while multinational companies can structure digitalization at a corporate level thanks to their strategic vision and investment capacity. This divergence prevents digital transformation from progressing homogeneously across the country and creates a significant imbalance within the ecosystem.

Across all three building blocks, the most striking difference appears at the organizational level. This gap stems largely from disparities in leadership, strategy development, and management capacity. While MNCs institutionalize transformation with investment support from global headquarters, SMEs remain anchored in day-to-day operational concerns. As a result, digitalization does not become embedded in organizational culture, and SMEs tend to adopt technology only in a partial, fragmented way. The lack of human resource development and digital skills programs further slows the transformation pace for SMEs. In contrast, the smallest difference between SMEs and large companies is seen in the Technology Building Block, indicating that both groups face similar constraints. Investments in sensorization, automation, and data collection remain limited across the board due to cost pressures—barriers that only MNCs can more easily overcome thanks to their scale and capital strength. The parallel differences observed in the process and technology dimensions show that process digitalization and technological infrastructure evolve together as an inseparable whole.

As company scale increases, improvements of roughly half a band are achieved in both building blocks, while the gap between SMEs and MNCs approaches a full band. This dynamic pushes smaller companies toward the lower tiers of the value chain. The combined effect of organizational gaps, technological weaknesses, and capital constraints reinforces the imbalance in digital transformation across scales in Türkiye. This picture makes it clear that SME-focused mechanisms are essential for achieving broad-based digital transformation. Applied training delivered through shared digital platforms, technology centers, and model factories – supported by low-cost technology adoption solutions – can help narrow the gap between SMEs and MNCs. In the long term, raising the digital maturity of SMEs will not only enhance their competitiveness but also strengthen Türkiye's overall position in global value chains.



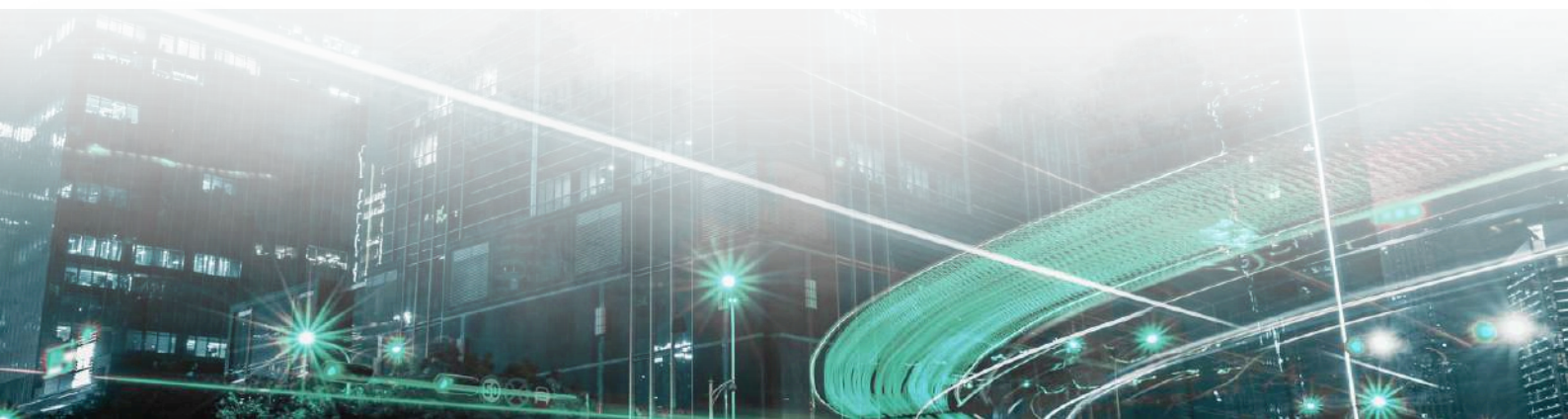
Figure 17 Türkiye's Overall Building Block Scores vs ISO 100 Companies



Comparing the results of large, institutionalized companies listed in the ISO 100 with all SİRİ participants in Türkiye reveals that scale, capital strength, and institutional capacity significantly influence the country's digital transformation trajectory.

The biggest difference between ISO 100 companies and other companies is that digitalization has become an “organizational reflex.” This is driven not only by investment capacity but also by the ability to scale solutions across the value chain. Among the broader sample of 500 companies, solutions often remain local – a single production line, a department, or a project – preventing digitalization from becoming an enterprise-wide standard. The large gap in organizational dimensions reflects that ISO 100 companies treat digital transformation not just as a technology investment but as a strategic practice. With clear governance mechanisms, strategic alignment, and mid-to senior-level leadership programs, these companies can embed technology into their business models.

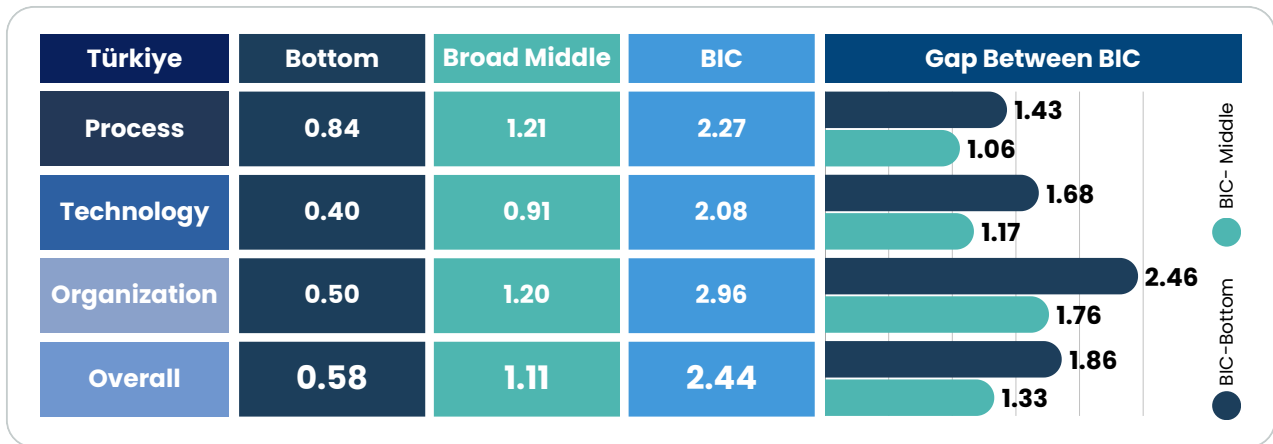
In contrast, many companies in the 500 sample can invest in processes and technology but cannot achieve the same impact due to gaps in organizational culture and management systems. ISO 100 companies have largely integrated industrial IoT, automation, data analytics and AI. In the broader group, technology investments remain isolated or are postponed due to perceived low ROI. This creates disadvantages not only in productivity but also in supply chain visibility, sustainability measurement, and building data-driven customer relationships. Overall, the picture shows that digitalization in Türkiye is developing in a “leader company-driven” pattern. ISO 100 companies elevate the ecosystem, yet the gap continues to widen as the rest of the base progresses at its own pace and with its own internal logic.



1.5. Türkiye's 3B Benchmark

This grouping was done to make the results of the 500 SIRI assessments in Türkiye more meaningful and to clarify the position of companies on their digitalization journey. Companies are categorized into three groups, ordered from highest to lowest: the best 10% are classified as **"Best-in-Class (BIC)"**, the bottom 10% as **"Bottom"**, and the remaining 80% as **"Broad Middle"**. This approach reveals not only average scores but also the magnitude of the gap between groups, identifying areas of widespread progress and areas of disparity across the country. This provides a clearer understanding of both the strengths of leading companies and the reasons why companies with medium and low digital maturity lag behind.

Figure 18 | Türkiye's 3B Benchmark in Building Blocks



The largest gap appearing at the organizational level shows that the primary brake on transformation is rooted in mindset and governance rather than in technology or processes. When leadership and strategy are absent, technology is reduced to an investment, preventing solutions from scaling and stopping digitalization from becoming part of the organizational culture. In this sense, organizational weakness is both a cause and a consequence of the technology gap. The technology gap is especially pronounced between the Best-in-Class (BIC) and Bottom groups, highlighting that digitalization in Türkiye has not yet spread to the grassroots level. This creates a "two-speed" economy: on one side, BIC companies are integrating advanced automation, IoT, and analytics; on the other, Bottom companies, where even basic sensorization and data flow remain limited.

This situation leads to a lack of data standardization across the ecosystem and increases integration costs throughout the value chain. Notably, the Broad Middle is relatively close to the BIC group in the technology dimension, indicating that this segment could advance rapidly with the support of shared platforms and standard, scalable solutions. Process-related differences are narrower, showing that certain operational disciplines - lean practices, SOPs, and quality procedures - are widely adopted in Türkiye. However, the real divergence appears in data-driven management and end-to-end integration. In other words, while "standard operations" exist across most companies, closed-loop systems and real-time performance management are implemented primarily by BIC companies.

Which Roadmap Should Be Followed?

● Bottom

The priority is to establish a minimum level of digitalization: introduction of standard workflows, basic sensorization, fundamental data collection, and visualization. In parallel, simple but continuous training cycles should be launched to build foundational digital skills.

● Broad Middle

The priority is to strengthen organizational capacity. This is followed by connecting existing digital “islands” end-to-end with standard technology packages (connectivity base layer, OEE / maintenance digitalization, MES-lite, common data model).

● Best-in-Class

The focus is on scaling efficiency through advanced analytics, AI applications, and cross-facility standardization.

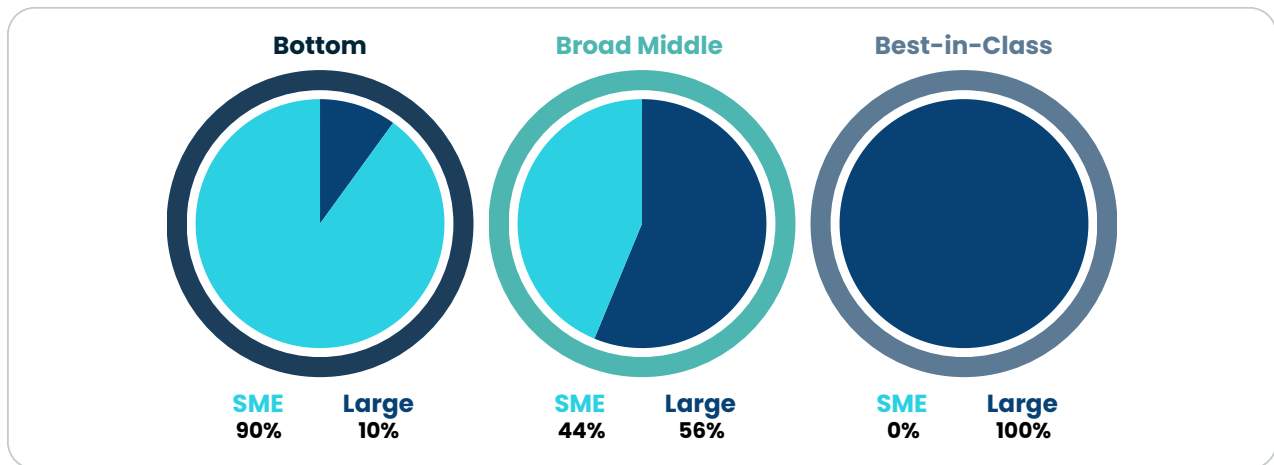
Key Insights

The largest gap appears in the organizational dimensions. Best-in-Class (BIC) companies treat leadership, strategy, and workforce development as elements of cultural transformation, whereas Broad Middle companies address them in a fragmented way and Bottom companies often overlook them entirely. Weak organizational capacity slows the scaling of technology investments in Middle and Bottom groups. Institutionalization, strong mid-level manager leadership, and a culture of continuous learning are the main factors that differentiate BIC companies from the rest. The BIC-Bottom gap is widest in the technology building block. BIC companies operate integrated shop-floor systems supported by data analytics, while Bottom companies have limited sensorization and data flow, and the Middle group relies mainly on isolated digital islands. Notably, the distance between BIC and Middle is smaller than the gap within the organizational dimension, suggesting that the Middle segment can progress rapidly with the right governance and standardization. Process differences are the smallest, as lean practices and basic SOPs are widespread nationwide. BIC companies differentiate themselves through end-to-end integration and a data-driven decision-making culture. Overall, the 3B analysis shows that Türkiye’s primary digital divide lies within the organizational dimension. Processes offer the fastest path for convergence, while technology requires the most capital investment and ecosystem support to close the gap.

1.6. Benchmarking Digital Maturity Across Company Sizes

The extremes of digital maturity in Türkiye almost perfectly align with differences in scale: while nearly all of the bottom 10% consists of SMEs, the entire best-in-class 10% comprises only large-scale companies. This situation demonstrates that differences in scale are decisive not only in terms of capacity but also in terms of the pace of digital transformation. Collaborations and scalable solutions that facilitate SMEs' access to technology investments can contribute to making this gap not a natural barrier but a surmountable stage of development.

Figure 19 | Company Size Based Analysis on 3B Benchmark of Türkiye



The concentration of SMEs in the bottom 10% confirms that the fundamental bottleneck in digitalization lies within the SME ecosystem. The majority of SMEs consist of businesses that have not transitioned to basic infrastructure such as ERP/MES, operating manually or managing with fragmented systems. This picture clearly shows that the way to raise Türkiye's overall maturity lies in SME-focused programs.

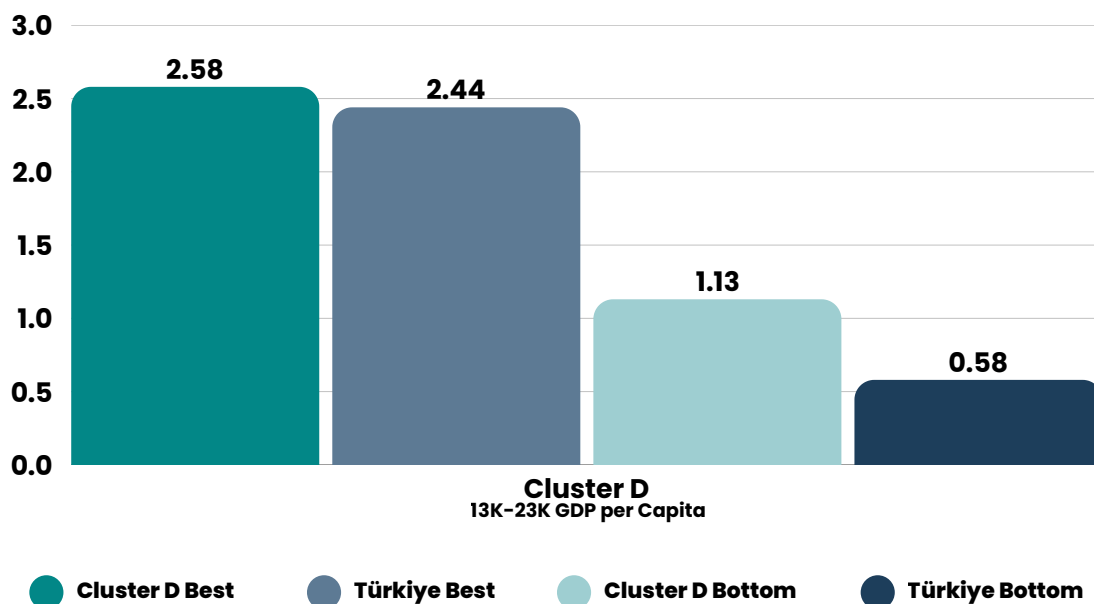
On the other hand, the fact that there are only 5 large companies in this class shows that most large companies have not fallen to the bottom in terms of digitalization. This data proves that there is a "minimum baseline" among large companies. The balanced distribution in the Broad Middle is noteworthy. This picture can be interpreted in two ways: some large companies are unable to move forward, while some SMEs are able to break out of the bottom group. In other words, scale difference ceases to be the determining factor here; the real scale difference emerges at the extremes. The absolute dominance of large companies in BIC highlights how critical scale, global connections, R&D power, and access to capital are. However, a side effect of this situation is "polarization": the gap between large companies and SMEs is widening.

SMEs also need to pass the certification, traceability, and data standard barriers in global value chains. If this situation does not change, the performance of large companies at the BIC level may become unsustainable because the supply chain is only as strong as its weakest link. Türkiye's average cannot rise without SMEs rising from the bottom. Focusing digital transformation programs on pulling SMEs in the bottom 10% into the middle band will be highly effective for systemic transformation. Providing a "minimum digital infrastructure" (ERP/MES integration, data collection, energy tracking) will raise the digital maturity score of even the lowest class by at least one band. Strengthening BIC's locomotive role is crucial. The best-in-class 10% should not only be a showcase but also a mechanism that drives standards downward. To achieve this, minimum data standards and mandatory traceability criteria must be disseminated through sectoral supply chains. The absence of SMEs in BIC hinders Türkiye's long-term innovative SME-based growth model. The current structure reinforces the perception that "BIC is only for large companies." The failure of Tier-2/3 SMEs in export markets to meet traceability requirements also jeopardizes the competitiveness of Tier-1 large companies in the market.

BIC & Bottom Comparison in Terms of GDP

In the global analysis, countries are divided into five clusters (Cluster A–E) based on their GDP per capita levels. Türkiye is in Cluster D, which covers the \$13,000–23,000 range. This class represents upper-middle-income economies.

Figure 20 | Global & Türkiye Comparison with Bottom & Best-in-Class Average Scores



When Türkiye is compared to the digital maturity of countries in the same class, it is seen that the gap is not in the Best In Class cluster but in the Bottom cluster, which shows the lowest performance. The fact that 90% of this cluster in Türkiye consists of SMEs highlights the importance of SME development in eliminating this gap. The best-in-class gap is very low: Türkiye's BIC is 2.44, while the Cluster D average is 2.58. This shows that Türkiye's best companies are almost on par with their competitors in countries in their own income group. In other words, Türkiye has no disadvantage at the top end; its strongest companies are neck and neck with the leaders of countries in the same income league.

Global Source: INCIT

The bottom difference is dramatic: Türkiye's bottom score is 0.58, while Cluster D's is 1.13. This means that the companies with the lowest digital maturity in Türkiye lag behind even the lowest-performing companies in countries with similar income levels. This reveals that the digitalization threshold is much lower across the broader ecosystem. This finding is another consequence of the fact that nearly all of the bottom 10% of the 500 SİRI companies in Türkiye are SMEs, and there are no SMEs in the BIC class. Polarization is the most prominent problem: The fact that Türkiye's best are close to the global level, while the bottom companies are far behind, proves that digitalization is "polarized."

In Cluster D, the gap between the bottom and the top is generally more balanced; in Türkiye, however, this gap is wider. One reason is the structural SME problem: Many SMEs in Türkiye still operate with manual processes, which severely drags down bottom performance. Companies should have basic infrastructure such as ERP, automation, or digital traceability. As a result of this gap, while BIC companies in industries such as automotive and electronics are exporting strongly, quality and speed problems are being experienced in supply chains due to low-maturity suppliers. This could threaten export competitiveness in the long term.

Structural Barriers Preventing SMEs from Entering the BIC Class

1. Capital and Turnover Limits

SMEs' limited turnover makes them more cautious about large-scale digitalization projects. Most businesses view solutions such as MES, ERP, or AI-based analytics as systems that require "high initial investment and ongoing maintenance costs." This perception reinforces the chain of "low turnover = low investment capacity." The real problem is not so much the absolute size of the investment, but rather the lack of appropriate models to scale the investment.

2. Lack of Expertise

While large companies have digital transformation departments, CIO-level managers, data engineers, and similar roles, in SMEs these tasks are often performed by the production manager or accounting manager. Consequently, there is a lack of expertise needed to plan advanced technology investments, select the right modules, and manage them.

3. Short-Term Cash Flow Priority

Most SMEs manage their cash flow on a weekly or monthly basis. Therefore, a digital investment that may take 2-3 years to pay off can be relegated to the background, even if it will bring efficiency in the long run.

4. Weak Customer and Regulatory Pressure

Tier-2/3 suppliers or small manufacturers working in the domestic market do not usually experience direct pressure to "go digital or go home." This keeps their motivation to climb the BIC low.



Question: Does It Require Significant Investment to Be Best-in-Class?

The answer to this question is definitely no. The BIC level is not only dependent on expensive infrastructure investments, but also on the “ability to scale and integrate investments.” However, the effectiveness of all these tools is not limited to the individual efforts of SMEs. For SMEs to reach the BIC level, it requires a coordinated and synchronized transformation in the value chain rather than individual investments.

- **Shared platforms (SaaS):** For example, instead of setting up its own MES system, an SME can use an industry-specific cloud-based production monitoring system to access the same functionality at a much lower initial cost. This approach overcomes the capital barrier and allows SMEs to quickly integrate into the value chain by working with the same data standards as large companies.
- **Shared data pools:** When large manufacturers establish API-based quality and traceability integrations with their suppliers, SMEs can connect to this shared data pool and directly share product quality, test results, or logistics data. This keeps costs low and allows SMEs to more easily meet the transparency and traceability standards that are becoming mandatory in the global market. Therefore, “supplier development programs” should extend to Tier-2/3, leading the way for SMEs to reach BIC level.
- **Green/digital financing packages:** Banks’ “energy efficiency investment” or “digital traceability” credit models reduce the investment barrier by linking repayments to project returns.
- **Modular investments:** Starting with small modules such as sensors and OEE software per machine, rather than a fully integrated MES, provides high benefits with low risk.



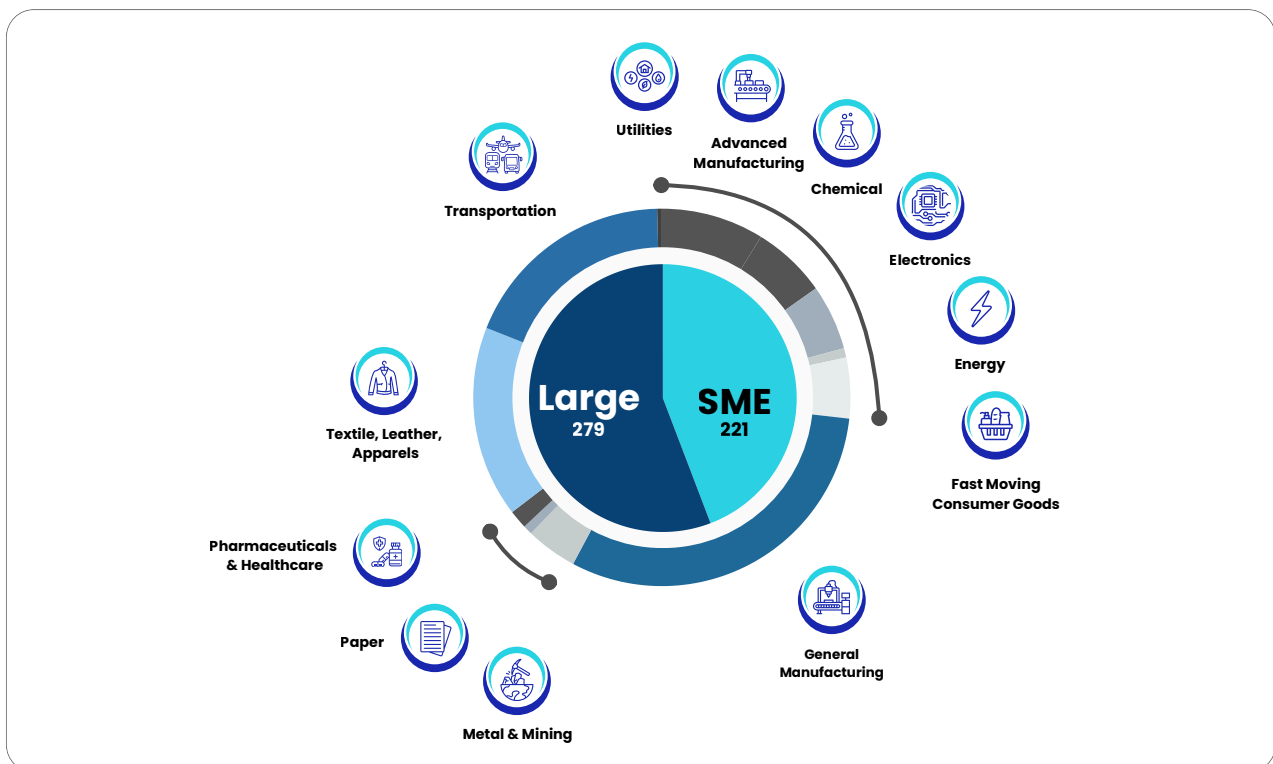
Chapter 2 | The Landscape of Türkiye's Digital Transformation

Over the past five years, Türkiye's digital transformation journey has advanced at different speeds across industries and company sizes, yet it has often fallen short of its full potential. Based on 500 SIRI assessments, this section provides an integrated view across the Building Blocks, including SME–Large–MNC comparisons and 3B segmentation, to clarify where strengths are concentrated and how persistent challenges have become structural.

2.1. Distribution of SIRI Assessments by Industry & Company Size

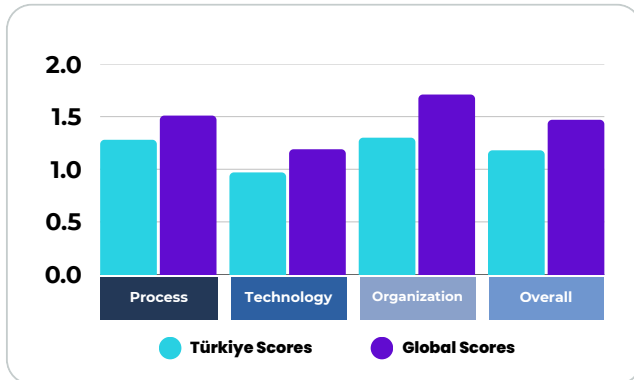
The chart below presents the distribution of 500 SIRI assessments conducted in Türkiye over the past five years by industry and company size. While large companies account for a greater share of assessments, the strong representation of SMEs indicates that digital transformation efforts are not limited to a small group of leading companies but extend across a broad base of the industrial ecosystem. The prominence of traditional industries such as textiles, metal, mining, and general manufacturing indicates a strong focus on sectors where transformation needs are most acute. The high representation of transportation reflects the strategic weight of the automotive ecosystem in particular. This industry mix is driven more by the economic scale and position of sectors in Türkiye than by their digital maturity. Nevertheless, it offers valuable signals on how digital transformation is being shaped by differing industry dynamics.

Figure 21 | 500 Assessment Breakdown by Industries & Company Size



2.2. Comparison of the Building Blocks – Türkiye vs Global

Figure 22 | Türkiye & Global Building Blocks



Global Source: INCIT

Overall, Türkiye has established a baseline through standardization of processes and foundational digital initiatives. However, organizational maturity still limits the ability of technology investments to gain traction and scale. Globally, companies place organizational development and a culture of collaboration at the core of digitalization, whereas in Türkiye, it is still not a company-wide management practice.

Türkiye comes closest to global benchmarks in the process dimension. Figure 20 shows that processes are defined and executed by humans with the support of analogue tools mostly, and digital tools to an extent. However, despite processes being defined, they are managed and executed in silos, and system-level integration remains limited. This suggests that although Türkiye is near global levels on process maturity, it has not yet internalized the changes needed to deliver a step-change in productivity.

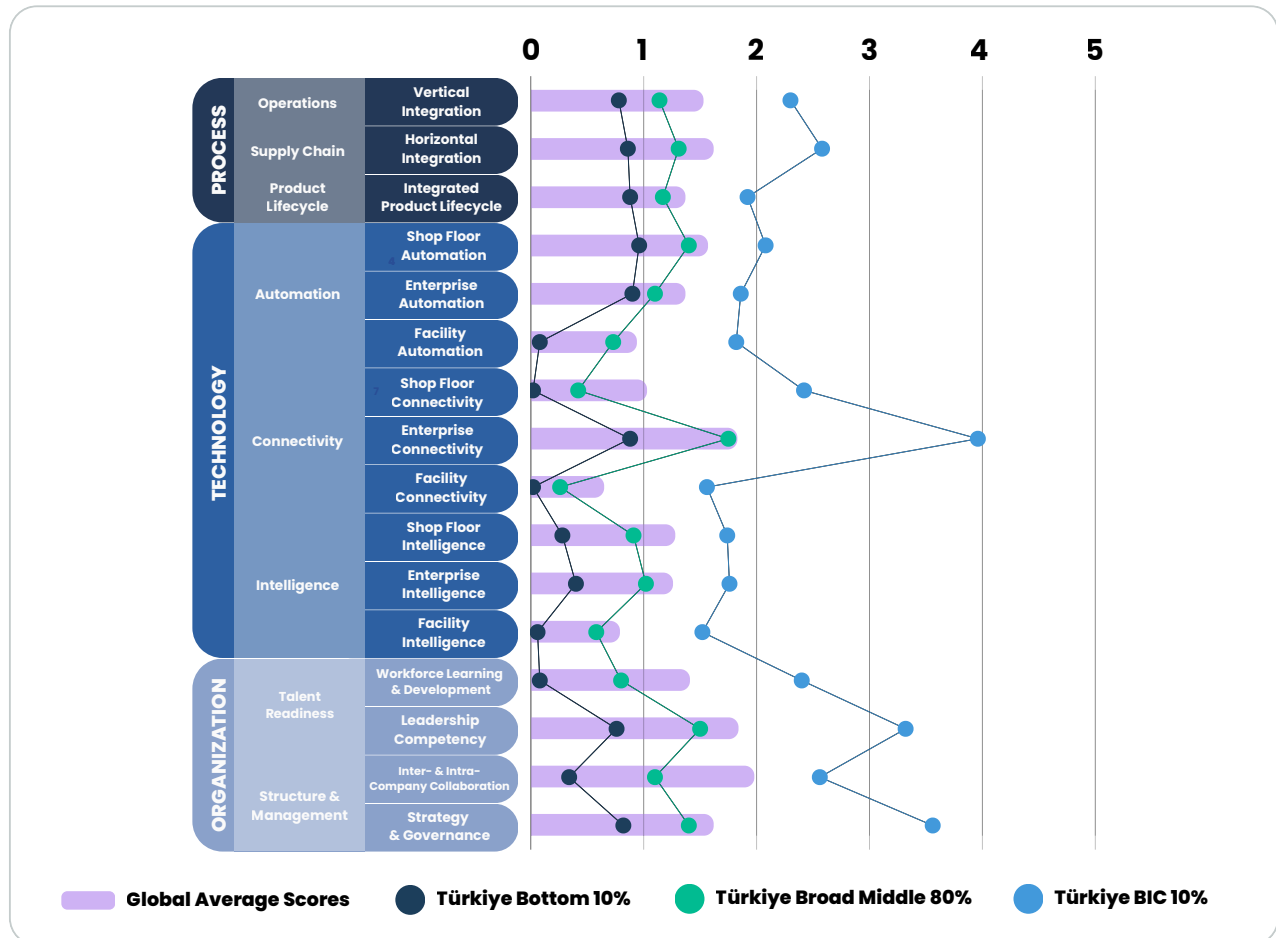
The gap between Türkiye and global averages is nearly the same in the Process and Technology Building Blocks. This indicates a shared “middle-maturity” challenge in both workflow digitalization and technology infrastructure. In other words, Türkiye has built a baseline in both areas, but the lack of system integration, automation, and connectivity limits further progress. The real divergence appears in the organizational dimension, where the gap is more than 30%. This suggests that global companies take a more systematic approach to adapt their organizational structures and processes to allow their workforce to keep up with the pace, while in Türkiye, these areas are still treated as secondary. The clearest implication is that Türkiye’s future momentum will depend not only on technology and process investments, but also on strengthening organizational capacity.



2.3. Global Comparison of Türkiye's 3B Benchmark Performance

This section highlights two critical realities of Türkiye's digital transformation journey. First, the Broad Middle consistently trails the global pace. Second, Best-in-Class companies are progressing in selected areas, yet they remain constrained in advanced technology layers, particularly analytics-driven capabilities.

Figure 23 | Türkiye 3B Scores, Compared with Global Scores



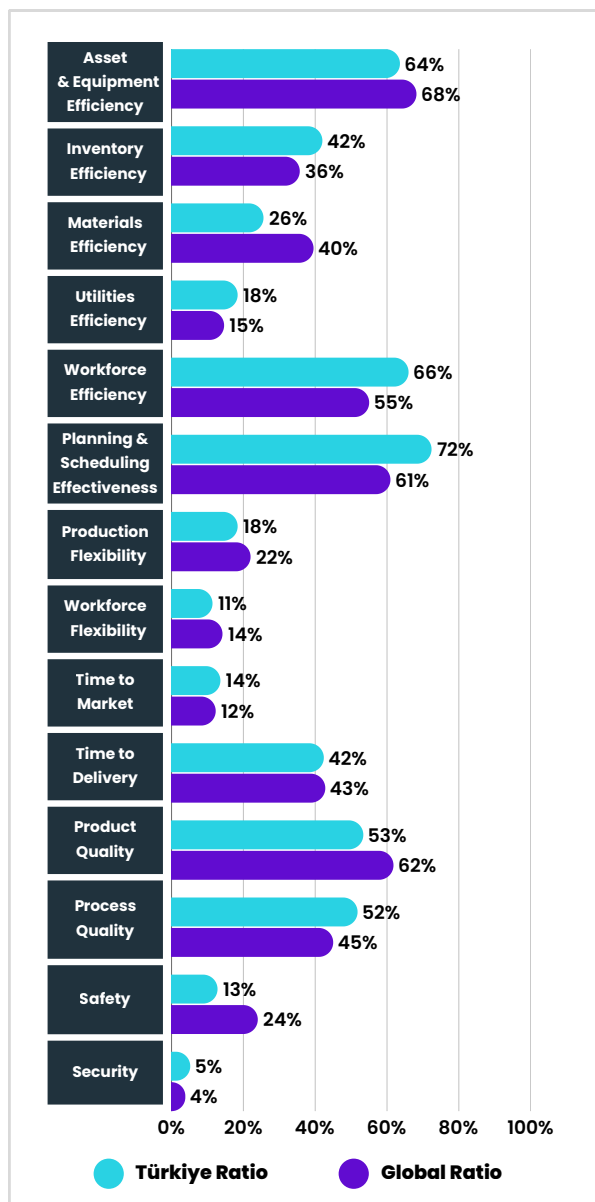
Global Source: INCIT

The lack of Strategy & Governance and Inter- & Intra-Company Collaboration in the Bottom group shows that these companies still treat digitalization as a “project” rather than embedding it into organizational culture. Facility Automation, Facility Connectivity, and Workforce Learning & Development are close to non-existent, and Shop Floor Connectivity is also very limited. In contrast, Shop Floor Automation and Enterprise Connectivity are relatively stronger, typically around Band 1. This suggests fragmented adoption, concentrated on isolated production initiatives or basic administrative systems, without end-to-end integration. The Broad Middle presents a more balanced profile. Enterprise Connectivity is close to the global average, indicating comparable use of data in core enterprise systems. However, the gap widens at the shop-floor and facility layers, and in collaboration. The shortfall in shop-floor-related dimensions suggests that operations remain siloed and that the backbone for consistent data flow is still incomplete. This gap is both a risk and an opportunity, as targeted investments in these priorities can narrow the distance to global averages relatively quickly.

By contrast, the lag in Workforce Learning & Development and Inter- & Intra-Company Collaboration is more structural. It requires cultural change and trust-based mechanisms, not only additional technology investment. In contrast, the strong performance of Best-in-Class companies in Leadership Competency, Strategy & Governance, and Inter- and Intra-Company Collaboration shows that transformation accelerates when leadership sets a clear direction and organizational alignment is strong. The critical point, however, is that even these companies remain below the global average in automation and intelligence dimensions. This indicates that advanced automation and data-driven decision-making have not yet reached their full potential in Türkiye. In the short term, Türkiye can narrow gaps in Connectivity, Vertical Integration, Horizontal Integration, and collaboration areas. Over the longer term, reaching global Best-in-Class levels will be difficult without strengthening the Intelligence layer, which is likely to be the decisive differentiator for sustained competitive advantage.

2.4. Review of Key Performance Indicator (KPI) Selection Patterns

Figure 24 | KPI Selection Ratio



Global Source: INCIT

Differences in KPI selection between Türkiye and global benchmarks reflect company priorities, operating pressures, and competitive context. In Türkiye, the strong emphasis on labor productivity and planning & scheduling effectiveness suggests that labor-intensive production structures and demand volatility remain decisive. Companies, therefore, prioritize planning and workforce management to reduce bottlenecks and increase operational flexibility.

Globally, higher selection ratio for areas such as cybersecurity and material efficiency point to a different set of drivers. Sustainability commitments and more mature digital infrastructures increasingly shape KPI agendas, pushing companies toward resource efficiency, compliance readiness, and risk management.



Most Frequently Selected KPIs Globally Compared to Türkiye

Materials Efficiency: This KPI ranks high globally due to sustainability pressures and rising input costs, making raw material efficiency a strategic priority. In Türkiye, raw material costs are also high, but companies tend to manage them primarily through price negotiations and supply chain measures. A systematic “materials efficiency” discipline is not yet widely embedded.

Safety: For global companies, safety is a top KPI driven by strict regulation, strong employee protection standards, and Environmental, Social, Governance (ESG) expectations. In Türkiye, production pressure and cost constraints often push safety lower on the KPI agenda, and it is more frequently treated as a compliance requirement than a performance driver.

Product Quality: Globally, product quality is positioned as a foundation for customer satisfaction, brand strength, sustainable market share, and higher value-added production. In Türkiye, process quality is more commonly selected, reflecting a stronger focus on reducing in-process errors than on end product outcomes. This points to a more operational efficiency-driven mindset, rather than a customer and market expectation-driven one.

Most Frequently Selected KPIs in Türkiye Compared to Global

Planning & Scheduling Effectiveness: This KPI is selected far more often in Türkiye than globally. Sudden order changes, small-batch requirements, and uncertainty in delivery conditions are more common, making planning agility a key risk-control mechanism in daily operations. In global benchmarks, more mature planning tools and forecasting practices reduce the need to position flexibility as a primary safeguard.

Inventory Efficiency: Globally, more advanced supply chain integration supports leaner inventory practices. In Türkiye, unpredictable lead times and rapidly shifting customer demand make inventory a strategic buffer, not only for cost control but also for protecting service levels and delivery performance.

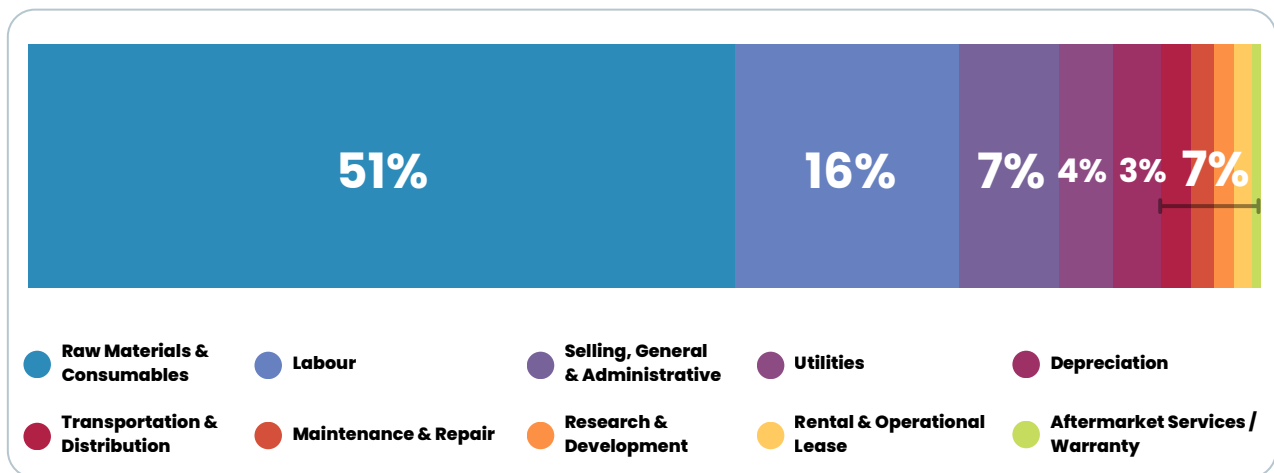
Workforce Efficiency: Globally, this KPI tends to rank lower because automation levels are higher and labor dependency is lower. In Türkiye, the workforce plays a more critical role on production lines, and some companies also have seasonality challenges and regional labor dynamics. As a result, workforce efficiency is a core indicator for maintaining stable output.

Process Quality: Process quality is prioritized more in Türkiye than globally. While product quality is closer to end-customer outcomes, companies in Türkiye often focus on reducing quality losses through internal process control and standardization. In global companies, process quality is reinforced through automation and analytics, whereas in Türkiye, it is more frequently managed through manual controls and intermediate checks, elevating its importance as a standalone KPI.

2.5. Cost Profiles of Türkiye

Cost profiles are fundamental structural factors shaping sector competitiveness and digital transformation priorities. The composition of costs influences not only production economics but also companies' capacity to invest in technology, improve productivity, and make strategic decisions. Cost drivers such as raw material intensity, labor structure, and energy consumption are among the most critical indicators determining where companies focus their digital transformation efforts and which use cases deliver the highest impact.

Figure 25 | Türkiye Overall Cost Profile Breakdown



Raw Materials and Consumables (51%) account for more than half of total costs and represent the most significant dependency in the Turkish industry. This structure increases exposure to global supply chain volatility. As a result, companies often approach digitalization through productivity and waste-reduction goals that relieve immediate cost pressure, which aligns with the high prioritization of Planning & Scheduling Effectiveness and Process Quality in Türkiye. However, Materials Efficiency is selected below the global average in KPI preferences. In other words, the largest cost item is not consistently tracked as a strategic KPI. This suggests that short-term cash flow pressures often outweigh long-term efficiency programs. In raw material-intensive sectors such as textiles, metals, and chemicals, even incremental digital improvements can meaningfully influence total cost, given the size of this component.

Labour costs (16%) represent the second-largest item in Türkiye's cost profile. Many companies operate under tight delivery commitments and rising skills requirements, making stable workforce planning and effective utilization a strategic necessity. From a transformation perspective, digitalization and automation should be positioned as tools that support employees and elevate operational performance. When combined with upskilling and safer, more standardized ways of working, these investments can help reduce variability, improve quality, and increase value added, while contributing to more sustainable employment and stronger industrial resilience.

Selling, General, and Administrative (SG&A) costs account for 7% of total costs, a relatively low share. This can indicate that many companies have not yet built large budgets for sales and marketing capability, and corporate support functions, keeping overhead lean and production-centred. It may also point to underinvestment in branding, international marketing, and digital sales channels compared with global competitors. In companies with stronger corporate structures, SG&A is often higher because broader commercial reach, brand-building, and stronger governance infrastructure increase overhead while supporting long-term competitiveness. Türkiye's low SG&A share can be a short-term cost advantage. Over the long term, it may constrain brand value creation, visibility in global markets, and overall organizational maturity.

Utilities costs (4%) are also critical to build resilience against energy price volatility; energy efficiency is not only a cost lever but also a risk-mitigation strategy. Digital energy management, IoT-based consumption tracking, and smart maintenance therefore stand out as a high-impact area with fast payback.

Depreciation (3%) and **Maintenance & Repair (2%)** costs provide signals on long-term asset management behavior. The relatively low depreciation share suggests continued reliance on aging equipment and restrained renewal investment. This structure can raise maintenance burden and makes predictive maintenance approaches more attractive as a way to reduce unplanned downtime and extend asset life.

R&D, Aftermarket Services / Warranty, Rental and Operating Leases, and **Transportation** together account for **5%** of total costs. Despite their smaller weight, these items are key differentiators for competitiveness. Low R&D share indicates strong short-term cost pressure, yet future advantage depends heavily on building capability in this area. Similarly, warranty and after-sales activities may be small in cost terms, but they are critical for customer loyalty and market sustainability, especially for export-oriented companies.

Türkiye's cost profile reflects a structure in which raw material dependency is high, labor costs rank second, and the remaining items are distributed across relatively small shares. This points to an operating model that is input-dependent, exposed to strong cost pressure, and often managed with a short-term decision horizon.

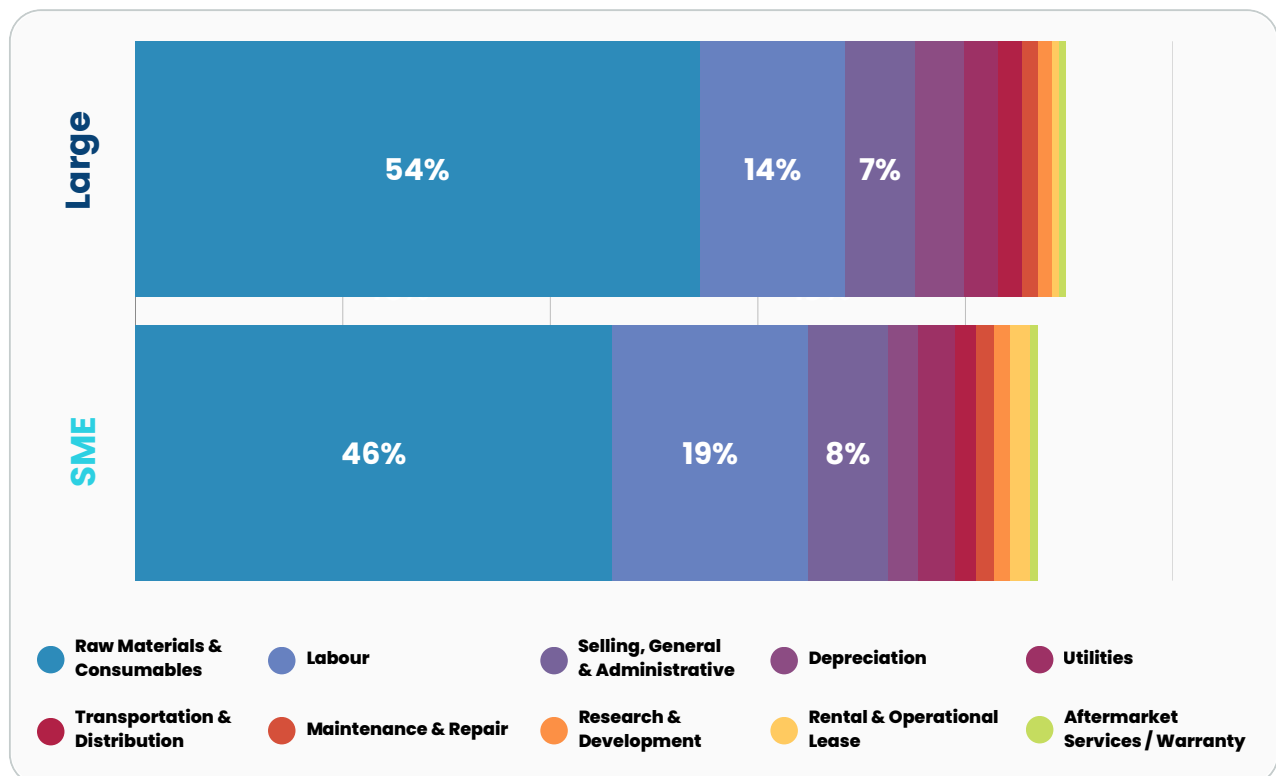
The most striking finding is the misalignment between the largest cost items and the KPIs companies prioritize. Although raw materials and energy represent the heaviest cost burden, they are not consistently positioned as primary performance indicators.



Analysis of Cost Profiles by Company Size

Cost structure reflects more than the distribution of expense items. It signals production scale, operating model, and where management attention is naturally directed. Large companies tend to show a cost profile weighted toward raw materials and consumables, shaped by high-volume and more standardized production. SMEs, by contrast, carry a relatively higher labor and operational overhead burden, reflecting more labor-intensive execution and tighter day-to-day process management. This structural difference also shapes productivity priorities. Large companies typically pursue competitiveness through input efficiency and loss reduction across material-heavy processes. SMEs prioritize stabilizing operational flow, improving workforce productivity, and reducing the frictions that arise from variability, rework, and manual coordination.

Figure 26 Türkiye Cost Profile Breakdown by Company Size



Raw Material Density and Scale Effect

In large companies, Raw Materials and Consumables represent a significantly larger share of total costs, around 8 percentage points higher than in SMEs. This reflects the scale effect, but it also signals a different operating model. Large companies tend to run more standardized, high-volume production, often with a more export-oriented mix. As a result, value creation leans heavily on materials efficiency, scrap reduction, and higher material yield. The paradox is that this cost pressure is not always mirrored in KPI choices. This creates a strategic misalignment between where costs concentrate and what gets managed as performance.



Labor and Operational Costs

In SMEs, labor and operational costs account for roughly 5 percentage points more than in large companies. Smaller batch sizes, frequent changeovers, and manual coordination drive this structure. It naturally elevates planning effectiveness, delivery continuity, and workforce productivity as practical priorities. In this context, SMEs can capture faster returns through low-complexity steps such as digitized workflows, shift and resource balancing, and basic end-to-end visibility in material and warehouse movements.

Rental & Utilities Expenses

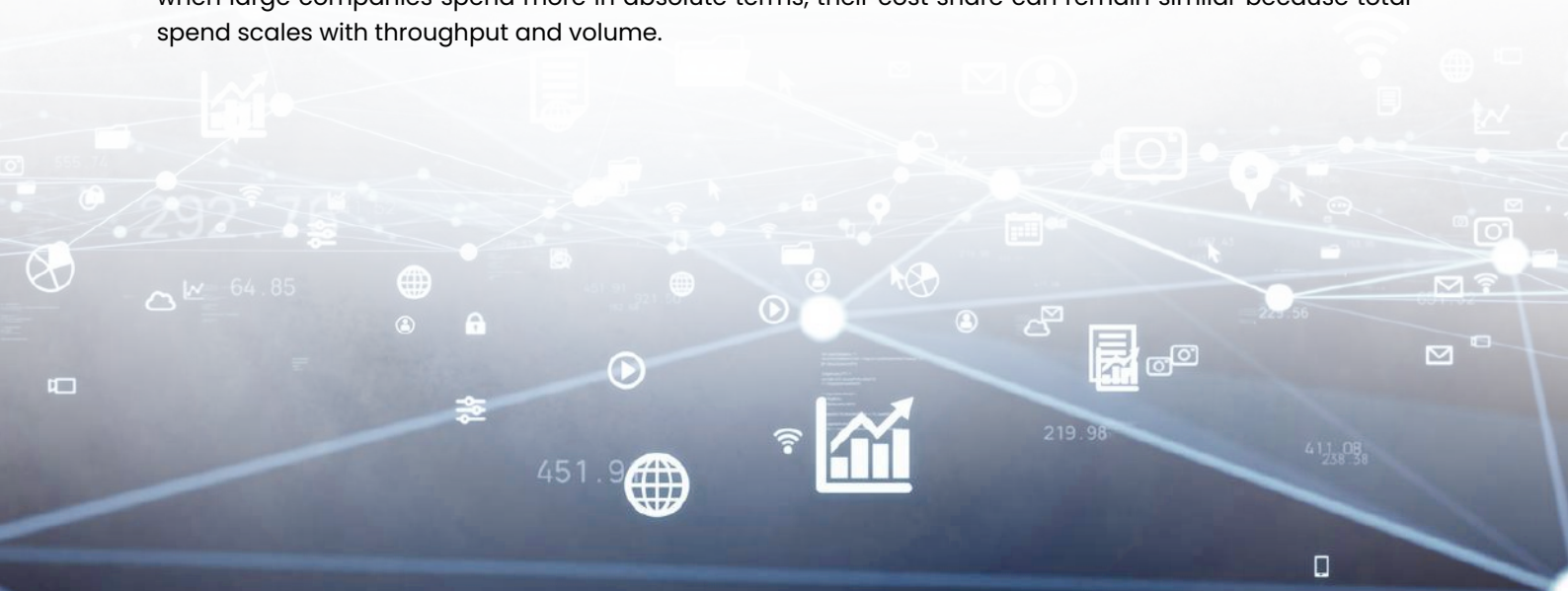
SMEs allocate nearly three times the share of costs to Rental & Operating Leases compared to large companies (1.95% vs. 0.71%). This pattern signals a structural financing choice. Many SMEs preserve flexibility by accessing machinery and facility needs through leasing rather than ownership. This lowers upfront capital requirements, but it can raise the cost share over time. Large companies, by contrast, are more able to fund assets directly. As a result, leasing remains a smaller line item in their cost base. Utilities show the opposite pattern. Large companies carry a materially higher utilities cost share than SMEs (4.68% vs. 2.89%). Scale reduces unit costs in some areas, but it does not automatically reduce energy intensity. High-capacity, continuous operations concentrate energy use and make utilities a more visible cost driver. Smaller and more flexible SME operations tend to dilute this intensity. As a result, utilities become a primary efficiency lever for large companies, while asset utilization and leasing efficiency play a similar role for SMEs.

Similar Trends in Other Items

In categories such as Maintenance & Repair, R&D, SG&A, and Transportation & Distribution costs, the difference between SMEs and large companies remains limited (typically under two points). This indicates that, beyond the major cost drivers, many operating expenses behave as “table-stakes” costs. They scale in absolute terms, but their share of the total cost base often remains comparable.

What the Similarities Actually Mean

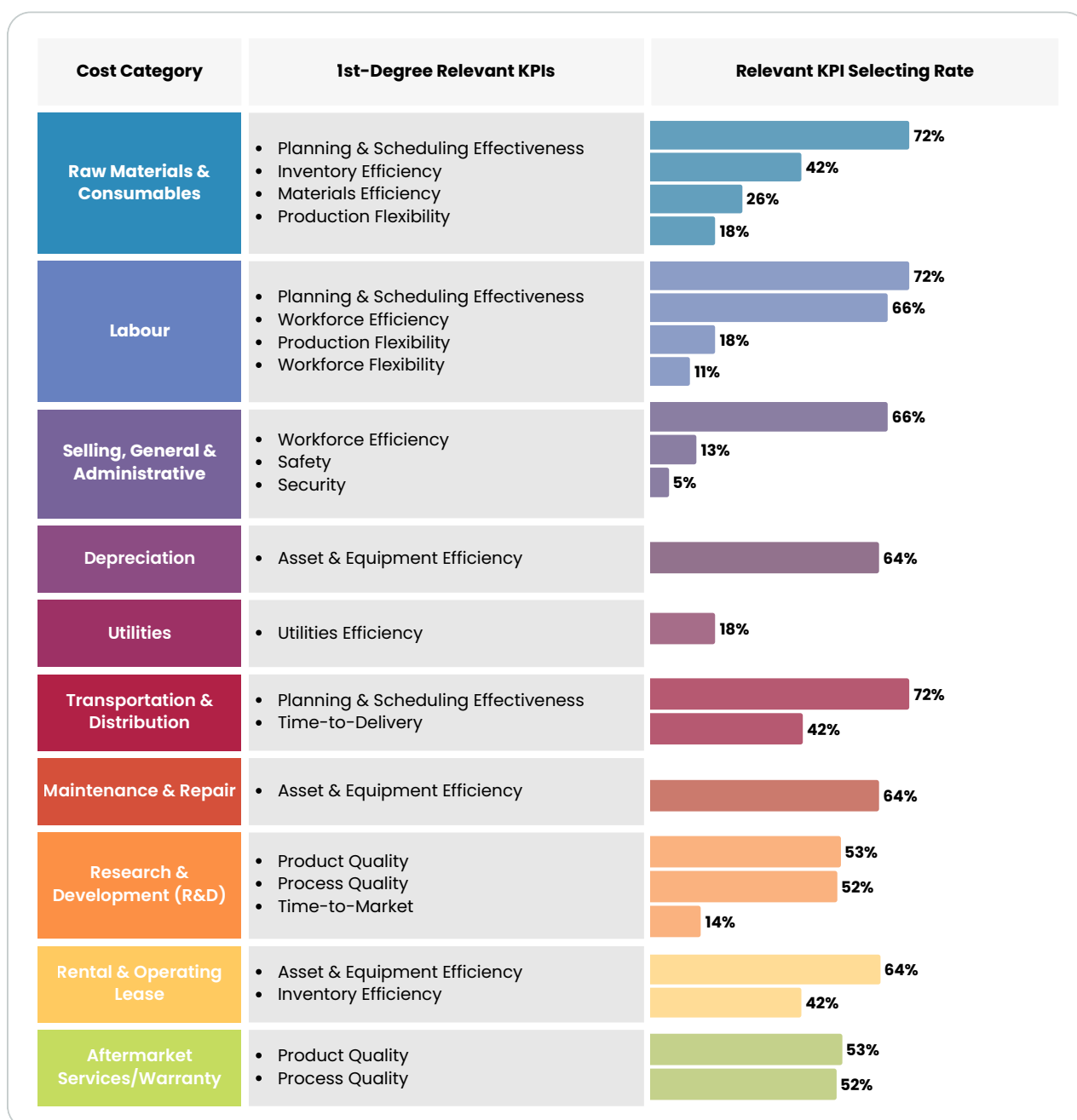
This relative convergence suggests that cost structure, by itself, does not create a wide strategic gap across most overhead lines. Many of these expenses represent minimum operational requirements. Even when large companies spend more in absolute terms, their cost share can remain similar because total spend scales with throughput and volume.



2.6. Relationship Between KPI Selection and Cost Profiles

Türkiye's KPI preferences are closely shaped by the dominant items in company cost profiles. Where raw materials and labor weigh most heavily, companies tend to prioritize planning and efficiency KPIs. In cost areas such as utilities and maintenance, the focus shifts toward equipment performance and utilities' efficiency. Overall, this pattern shows that short-term cost control remains the primary driver of KPI selection. Metrics linked to longer-term competitiveness – such as flexibility, safety, and time-to-delivery – receive comparatively less attention. The broad dominance of planning and scheduling KPIs signals a strong emphasis on operational discipline, while lower prioritization of flexibility and sustainability-oriented metrics highlights clear areas for improvement.

Figure 27 | Deeper Analysis on Cost Profiles of Türkiye



Raw Materials & Consumables

With 72%, Planning & Scheduling Effectiveness is the most frequently selected KPI. This indicates that companies prioritize supply planning and inventory control under high raw material cost pressure. However, Materials Efficiency (26%) and Production Flexibility (18%) remain significantly lower. Even in a raw material-intensive cost environment, the focus is placed more on managing material flow than on improving material usage efficiency. Recommendation: Elevating Materials Efficiency into a more strategic KPI could create an additional buffer against cost pressure and volatility.

Labour

The most frequently selected KPIs are Planning & Scheduling Effectiveness (72%) and Workforce Efficiency (66%). This underscores that human capital remains a central driver of production performance and competitiveness. However, Production Flexibility (11%) is notably low, indicating limited capacity to respond to demand volatility. Overall, workforce management is shaped mainly by productivity and operational discipline, while flexibility has not yet been positioned as a core resilience capability.

Selling, General & Administrative (SG&A)

The dominant KPI is Workforce Efficiency (66%). By contrast, Safety (13%) and Security (5%) remain at very low levels. This suggests that even in overhead and support functions, productivity is prioritized, while risk and compliance-related metrics receive limited attention. Over time, this imbalance can increase exposure as regulatory requirements tighten and customer expectations rise.

Depreciation

Asset & Equipment Efficiency (64%) stands out as the primary KPI. This is expected, as depreciation is closely tied to the effective utilization and useful life of assets. It also indicates a strong focus on improving returns on capital investments. At the same time, the prominence of this KPI can reflect pressure created by aging equipment and the need to maximize output from existing asset bases.

Utilities

The relatively low selection of Utilities Efficiency (18%) is noteworthy. It indicates that energy and utilities performance is not yet positioned as a strategic KPI despite its cost and volatility impact. Given energy price fluctuations and external dependency, utilities' efficiency should be treated not only as a cost lever but also as a key risk-mitigation instrument.



● Transportation & Distribution

Planning & Scheduling Effectiveness (72%) is selected more frequently than Time-to-Delivery (42%). This gap suggests that logistics performance is still framed primarily through internal efficiency and cost control rather than customer-facing speed. Elevating Time-to-Delivery as a strategic KPI would strengthen service reliability and customer satisfaction, and support long-term competitiveness, especially in export-oriented value chains.

● Research & Development (R&D)

The only prominent KPI is Time-to-Market (14%), and the low selection rate indicates that R&D is still not widely managed through strategic performance metrics. Companies appear to emphasize speed when R&D investment occurs, but the KPI profile suggests that innovation is not yet embedded as a consistent, system-level priority across the ecosystem. This is also consistent with an innovation capability that remains uneven and still developing.

● Aftermarket Services / Warranty

Product Quality (53%) and Process Quality (52%) stand out clearly. This indicates that after-sales costs are closely linked to quality performance across the value chain. Managing customer satisfaction and warranty-related costs is therefore becoming a more strategic agenda in Türkiye. If reinforced with disciplined quality management and data-driven feedback loops, this trend can enable companies to position after-sales services as a source of sustainable competitive advantage.

● Maintenance & Repair

Asset & Equipment Efficiency (64%) is the leading KPI, highlighting the direct link between maintenance spend and asset performance. This selection points to a growing shift toward more proactive asset management practices. At the same time, it also signals an intent to reduce continued reliance on reactive, breakdown-driven maintenance in parts of the industrial base.

● Rental & Operating Lease

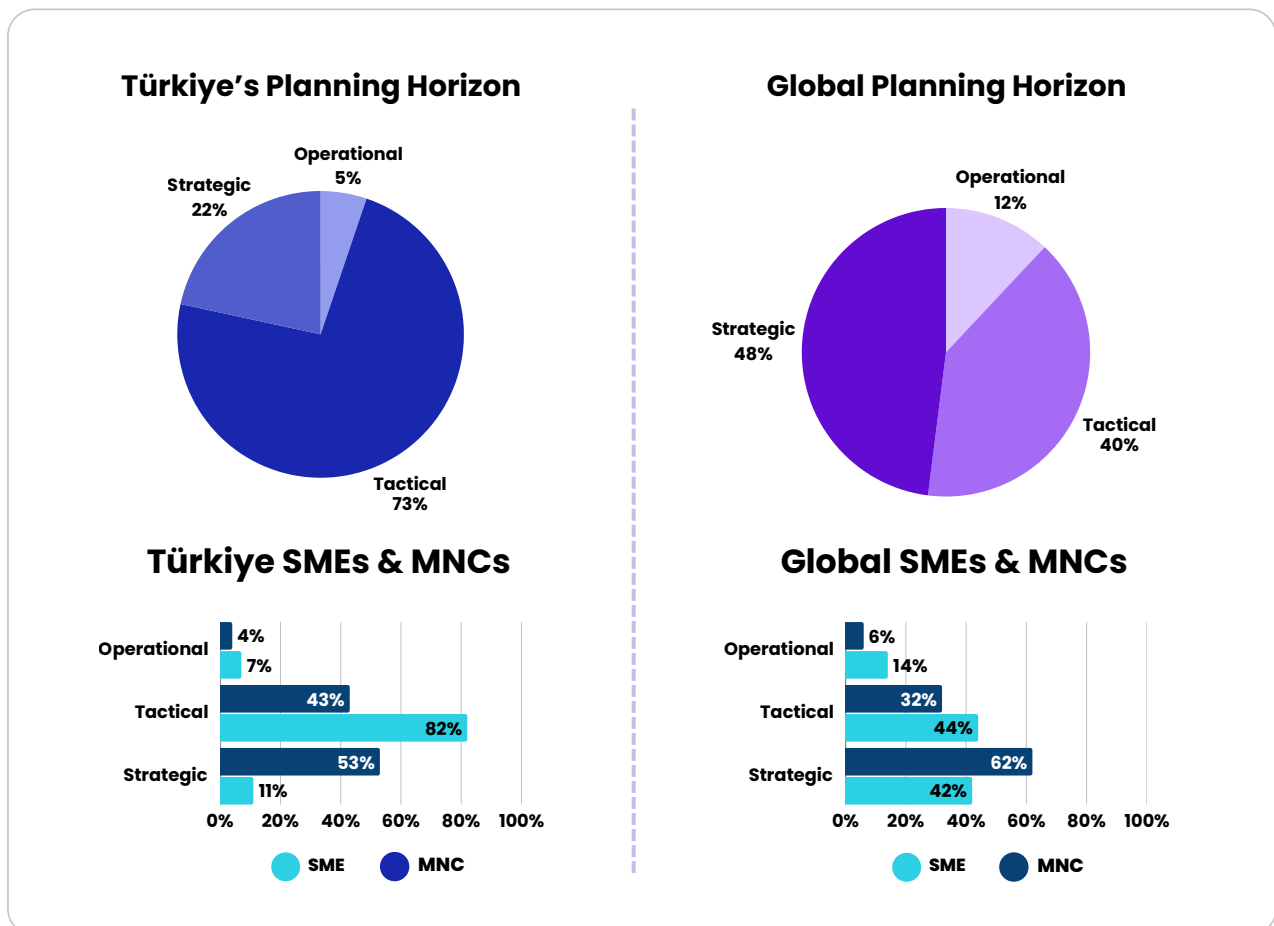
Companies primarily select Asset & Equipment Efficiency (64%) and Inventory Efficiency (42%). This indicates that performance monitoring remains essential even when assets are leased rather than owned. As leasing becomes more common in capital-intensive sectors, these KPI choices reflect the need for disciplined management of asset utilization and working capital under alternative ownership models.



2.7. Choosing the Horizon: How Türkiye Plans to Win

The planning horizon is a critical lens for understanding priorities in digital transformation. It shapes how cost pressures, KPI choices, and proximity to best-in-class companies affect day-to-day operations influence which dimensions receive the most attention. A strategic horizon reflects long-term direction and balance, a tactical horizon focuses on optimizing cost and resources, and an operational horizon emphasizes short-term execution and quick results under delivery pressure. For this reason, the horizon that a country or a group of companies tends to prioritize signals more than current preferences. It also provides clear clues about the transformation roadmap they are likely to follow.

Figure 28 | Türkiye & Global Planning Horizon Comparison



Global Source: INCIT

Across Türkiye, companies lean strongly toward tactical planning horizon (73%). This indicates that most companies operate with an approximately two-year horizon, prioritizing cost-driven and near-term objectives. Globally, by contrast, the strategic planning horizon (48%) is more prominent. This suggests a stronger emphasis on long-term transformation, innovation, and corporate capability building. Türkiye's low share of operational planning horizon (5%) also carries an important signal. It implies that companies are generally not locked into a day-to-day "survive today" mode, and instead gravitate toward medium-term tactical solutions. The higher global share (12%) indicates that, in some regions, short-term shock-driven planning remains more common.

Strategic Deficit for SMEs

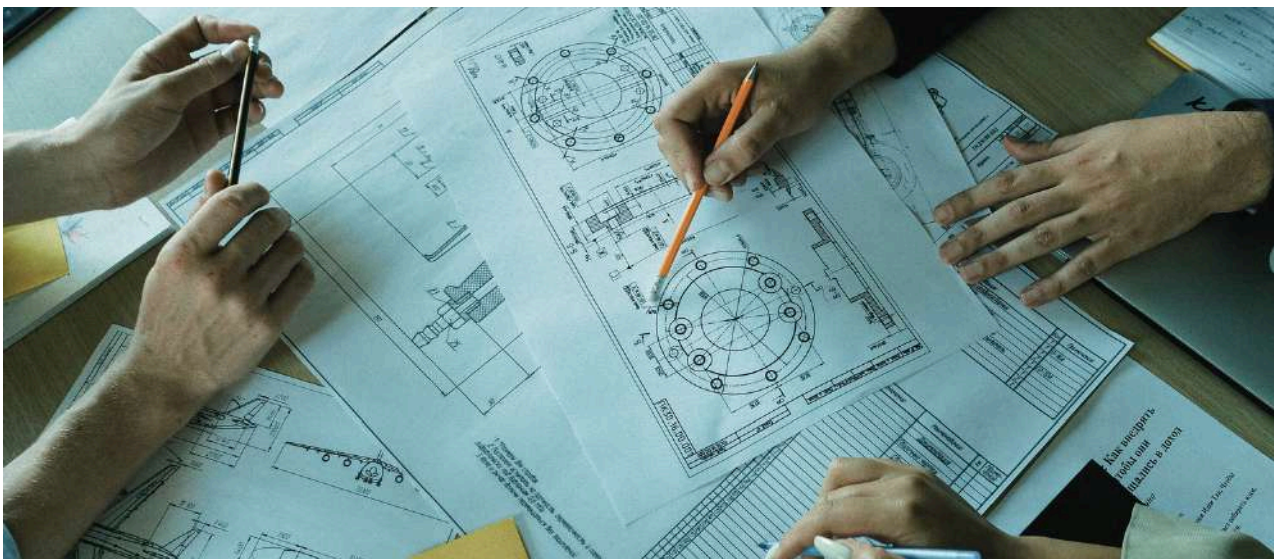
For SMEs in Türkiye, the fact that 83% operate with tactical planning, while only 11% adopt a strategic planning horizon, points to a highly one-sided preference. This stands in sharp contrast to the global SME profile, which is far more balanced (43% tactical, 44% strategic). The divergence is largely driven by short-term cost pressure and uncertainty, which crowd out longer-term priorities. As a result, gaps persist in long-term vision, innovation investment, and institutional capacity building. Closing this gap requires mechanisms that make strategic planning feasible for SMEs, including economies-of-scale support, fit-for-purpose financing tools, and ecosystem-based collaboration models that reduce risk and encourage longer-term commitments.

More Tactical MNCs

For MNCs, strategic planning accounts for 53% and tactical planning for 43% in Türkiye, compared with 62% strategic and 32% tactical globally. This indicates a more short-term, tactical bias. In other words, even globally oriented companies tend to rely more on tactical decision-making when operating in Türkiye.

Implicit Operational Approach in SMEs

On the operational planning side, the picture differs. Global SMEs select this horizon more often than Turkish SMEs, while MNC preferences remain similar in Türkiye and globally. This suggests that short-term operational reflexes are relatively standardized in large companies. For Turkish SMEs, the low 5% share appears counterintuitive given cash-flow sensitivity. It likely indicates that day-to-day pressures are absorbed into the tactical category rather than explicitly labeled as operational. In practice, SMEs seem to prioritize a 1–2-year “survival and stabilization” horizon over daily agility.

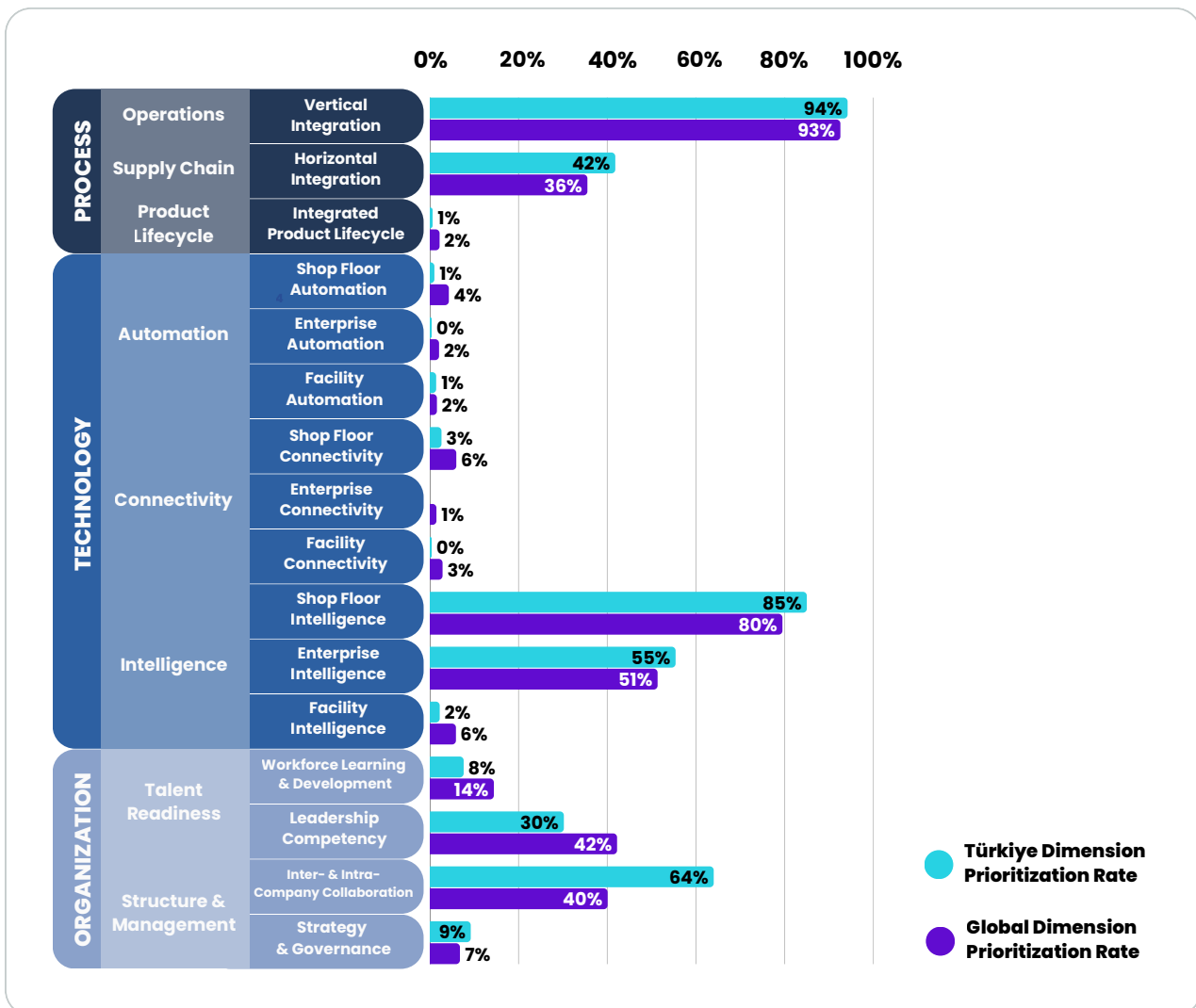


Overall, Türkiye’s planning horizon profile helps explain why digital transformation is often shaped around projects that are crisis-responsive and cost-driven. Globally, the stronger strategic orientation positions digitalization as a route to institutional capacity, sustainability, and competitive advantage. Closing this gap will require financing models, economies-of-scale tools, and ecosystem mechanisms that make strategic planning feasible, particularly for SMEs. The path forward is to combine disciplined short-term execution with a sustained long-term strategic direction.

2.8. Comparison of the Prioritized Dimensions – Türkiye vs Global

A comparative analysis of the prioritization (4 out of 16 dimensions) reveals more than the current maturity. It also indicates where cost pressure, KPI preferences, and strategic intent shape focus areas. The SIRI prioritization model is based on three key inputs: cost profile, KPIs, and proximity to best-in-class companies in the relevant industry. Planning horizon, on the other hand, applies weights to each factor explained above. The table below should therefore be read not as a simple preference ranking, but as a reflection of which transformation levers are prioritized under which structural constraints. Overall, Türkiye's priority pattern broadly resembles the global picture. However, differences in weighting point to a tension between short-term pressures and long-term capacity building. Given Türkiye's predominantly tactical planning orientation, priorities tend to favor dimensions that deliver faster visibility and near-term efficiency gains. Longer-horizon areas with slower payback – such as workforce development, connectivity, and facility-level dimensions – risk being deferred, which may limit the pace at which durable digital capability is built.

Figure 29 | Prioritized Dimensions Comparison



Global Source: INCIT

Note: The percentage shows how often the relevant dimension appears in the set of four prioritized dimensions across the 500 SIRI assessments.

Process Building Block Analysis

Vertical Integration is the top priority both in Türkiye (94.2%) and globally (92.6%), showing near-complete alignment. Ensuring uninterrupted data flow across processes within the factory walls has become the primary transformation lever in both contexts. Horizontal Integration is also prioritized at a high level on both sides, and it is even more prominent in Türkiye. This reflects the need to strengthen end-to-end digital connectivity across Türkiye's SME-intensive supplier networks. In contrast, Integrated Product Lifecycle remains a lower priority in both Türkiye and global benchmarks. This suggests that product development and engineering-led digitalization are still treated as secondary focus areas compared to operational advancement.

Technology Building Block Analysis

Overall prioritization rate for the automation related dimensions is higher globally. This reflects two structural factors: return on automation investments is shorter in many global markets, and a more strategic planning horizon pushes automation higher in prioritization. In Türkiye, where tactical planning dominates and cost pressure weighs heavily, automation dimensions rank relatively lower in the prioritization model. The lower prioritization of Connectivity in Türkiye compared to the global average is understandable in the short term. For lower-maturity environments, process improvements and data-driven visibility often deliver faster returns. In addition, legacy equipment, heterogeneous OT environments, cabling and EMC constraints, and cybersecurity segmentation requirements raise the entry barrier for connectivity investments. However, without connectivity, digitalization remains fragmented. Advanced analytics, AI and automation cannot scale when data does not flow reliably and in real time. Shop Floor Intelligence and Enterprise Intelligence are areas where Türkiye and global benchmarks largely converge. Türkiye's slightly higher prioritization suggests a stronger focus on data collection and visibility needs, and highlights this as a practical catch-up area with high impact on cost and performance.

Organization Building Block Analysis

Workforce Learning & Development and Leadership Competency are prioritized less in Türkiye than in global benchmarks. A key driver is that companies tend to deprioritize areas that are perceived as not delivering immediate financial impact. Under predominantly tactical planning horizons, workforce development is often treated as an "indirect benefit." Globally, however, capability gaps are increasingly viewed as a strategic risk, and sustained underinvestment can undermine long-term resilience and sustainability. Within the organizational dimensions, Inter- & Intra-Company Collaboration is prioritized more in Türkiye than globally. This reflects several reinforcing factors. First, a tactical horizon elevates dimensions that can support short-term cost control and operational efficiency, and collaboration is seen as a practical lever to reduce friction between supply, planning, and customer requirements. Second, Türkiye's stronger emphasis on planning- and productivity-related KPIs makes coordination across the value chain more urgent. Third, current-state results show that collaboration remains a relative weakness in Türkiye, which increases its priority due to high improvement potential. While global prioritization across leadership, strategy, and collaboration is more balanced, Türkiye's SME-heavy ecosystem and planning challenges make collaboration one of the most critical bottlenecks to address.

Chapter 3 | Measuring Industrial Progress in the Digital Era

SIRI assessments provide visibility beyond individual companies, helping map the digitalization journey of entire industries. By benchmarking results globally, it becomes possible to identify which industries are leading the transformation and which remain behind, clarifying where acceleration is most needed.

3.1. Comparison of Türkiye Archetypes with Global

The archetype approach captures the characteristic trajectory of digital transformation across industries. The archetype of an industry helps explain its development pattern. Some industries progress in a balanced and consistent way, while others are advanced but uneven, with high variation across companies. Others remain at an early stage or advance under more constrained conditions. For this reason, archetype classification is a useful tool for understanding the structural dynamics shaping industry digitalization. The archetype concept is built on two inputs: SIRI Maturity, which reflects the industry's collective maturity level, and SIRI Variance, which indicates how consistent or uneven transformation is across companies within the industry. This framing highlights not only industry averages but also the internal gaps behind those averages. Based on maturity and variance, SIRI groups industries into four distinct archetypes.

Archetype Descriptions

RAINFOREST

The industries in this group exhibit both high maturity and high variance. In general, most of the industry has advanced digitalization applications, but there are also companies within the same ecosystem that are lagging behind and unable to keep pace with the speed of transformation.

CONIFEROUS FOREST

This group, characterized by high maturity and low variance, indicates a strong and homogeneous digital transformation. Companies within this group are progressing at similar levels, with the differences between them narrowing significantly.

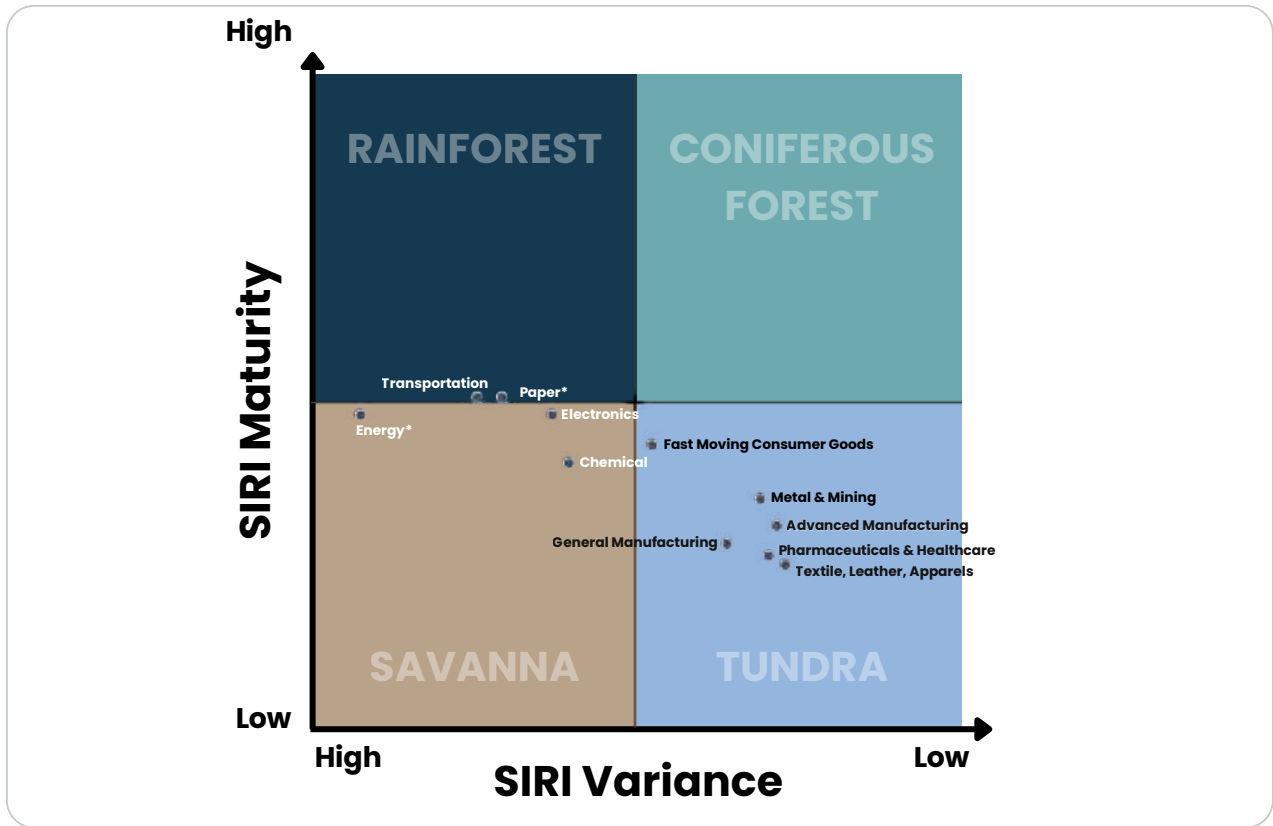
SAVANNA

This archetype is characterized by low maturity but high variance. The vast majority of the industry in this group is at the beginning of its digitalization journey, but there are a few strong players that stand out. This imbalance is particularly evident in SME-dominated industries; despite the progress of a few leading companies, the base lags clearly behind.

TUNDRA

Digitalization has generally remained limited in this group, where both maturity and variance are low. Most companies have not even taken the basic steps, and the general conditions in the industry make transformation difficult. Stronger external support, incentive mechanisms, and enabling solutions are critical to achieving progress in such industries.

Figure 30 | Archetype Graph of the Turkish Industries



*Each of these industries has four assessments, resulting in a disproportionately high score despite the limited data.

Solution: Standard “core digitalization packages” and scaled financing.

Low variance is an opportunity: The similar starting level in the tundra shows that the same recipe will work for many companies; rapid “base upgrading” is possible with single recipe–multiple facility programs. However, since there are few leading examples, the leap remains limited without creating lighthouse facilities.

Analysis Based on Industry Location in Archetype Graph

- Industries located in the Tundra cluster indicates that industry performance is generally and uniformly low; this points to systemic barriers (CAPEX, data/connectivity infrastructure, skills gap, regulation) rather than company-specific ones.
- The proximity of Transportation & Paper to Rainforest (high maturity, high variance) indicates a leading–long tail divergence in the industry; if variance is reduced through supplier development and standard transfer, the industry could leap forward as an ecosystem. (Note: limited sample warning, should prevent overconfidence in starred sectors.)
- Industries such as Electronics and Chemicals, which have high product/series variability and process complexity, are in the middle–lower group in terms of maturity, highlighting the need for PLM–MES integration. Without an end-to-end data model, maturity growth remains slow in these two industries.



- 1** Lift Tundra industries through baseline programs, standard digital packages, and fit-for-purpose financing. This helps industries move beyond the low maturity, low variance trap.
- 2** Scale what works in Rainforest industries (e.g., Transportation, Paper) by converting leading practices into reusable standards and deploying them across supply chains. This reduces variance and builds sector-wide momentum.
- 3** Turn Savanna differentiation into an advantage (e.g., Electronics, Chemicals) by codifying the practices of leading companies and spreading them through mentoring, joint projects, and structured supplier development. The goal is not only role models, but “mentors” that carry the ecosystem forward.
- 4** Reduce “digital islands” by enabling low-cost integration, especially for SMEs. Shared data pools, standard API-based platforms, and model factory-based cooperation mechanisms can accelerate connectivity and interoperability at scale.
- 5** Make archetype movement durable through talent readiness. Alongside technology, expand digital competencies through regional training hubs, university-industry collaboration, and mechanisms that reinforce continuous learning. This will help transitions from Tundra to Savanna become sustainable.

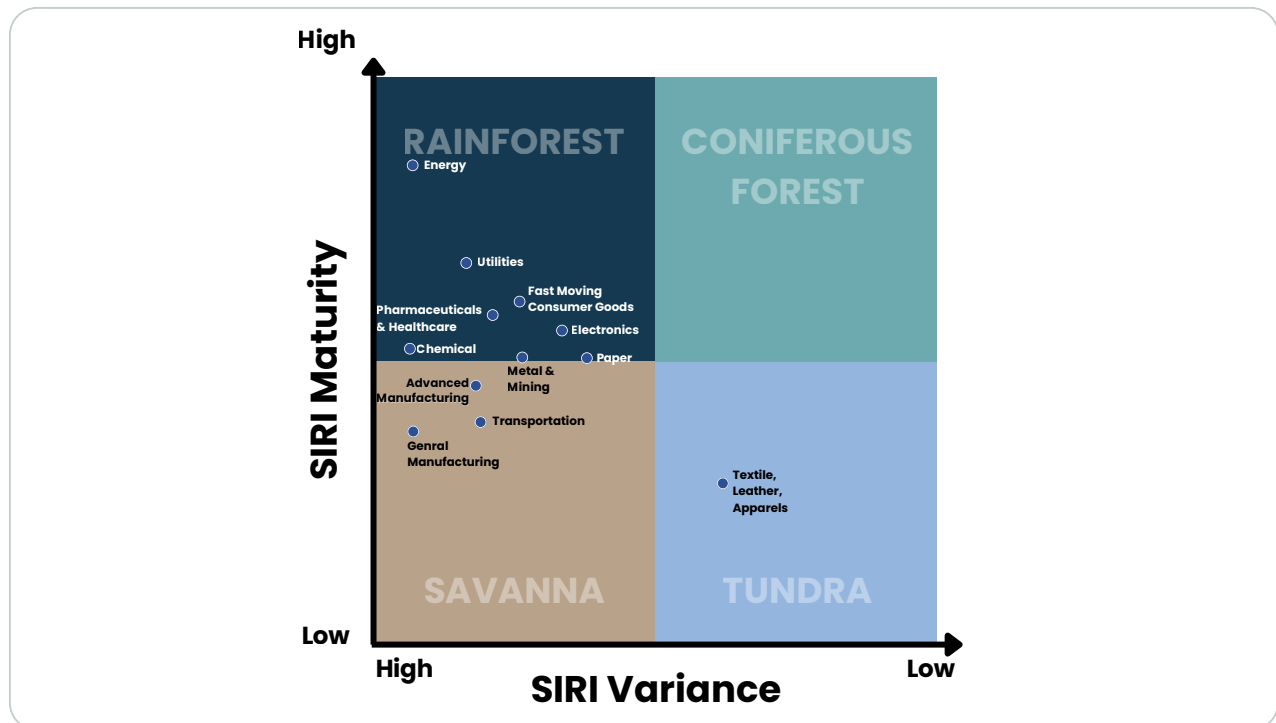
Together, these actions can lift the broad base while using the experience of Rainforest and Savanna pioneers to create a ripple effect across the entire country.



When Türkiye's overall archetype profile is compared with global benchmarks, some industries show striking similarities, while others display clear and structural differences.

While a significant portion of industries falls into the Rainforest on a global scale, the distribution is still not homogeneous, as the Coniferous Forest remains empty. In Türkiye, the pattern is notably different: many industries are concentrated in the Tundra and Savanna, indicating that digitalization is advancing in a more limited and uneven way. Particularly in SME-dominated industries, a broad-based momentum has not been achieved.

Figure 31 | Archetype Graph of the Global Industries



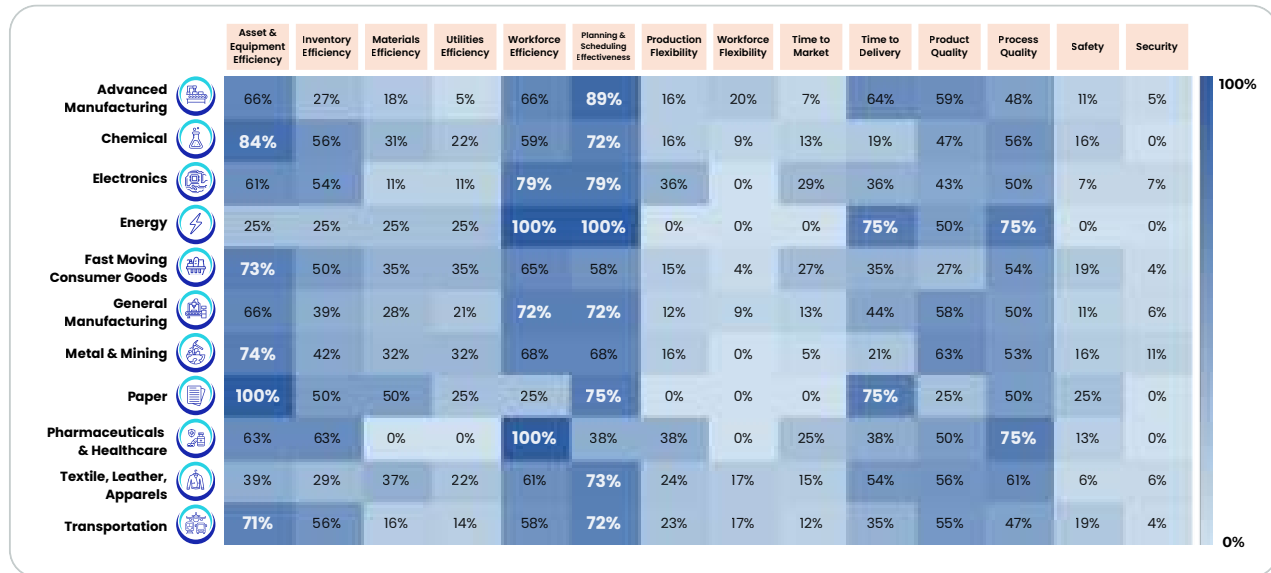
Source: INCIT

Both in Türkiye and globally, the pattern is similar: the Coniferous Forest is empty. In other words, no industries combine high maturity with high consistency across companies, so transformation tends to advance unevenly. This is a natural progression. Many industries first cluster in the Tundra (low maturity, low variance), a pattern that is even more visible in labor-intensive sectors. As leading companies and MNCs act as locomotives, the industry average rises, but variance also increases. The archetype then shifts toward the Savanna, and in some cases toward the Rainforest, where leadership clusters drive maturity. Türkiye's map reflects this "two-speed" dynamic. Strong clusters such as transportation and energy have moved into the Rainforest, while SME-intensive industries – especially advanced manufacturing, general manufacturing, and textiles – remain concentrated in the Savanna–Tundra band. The fastest route toward the "ideal" Coniferous Forest is to move from isolated lighthouse projects to ecosystem-scale architecture. This requires systematically reducing variance through supplier development programs that are driven by measurable KPIs, ensuring connectivity, shared data, and integration standards, and SME-focused competency academies. These measures can first pull the Savanna closer to the Rainforest by lifting the base. They can then narrow the variance to move industries toward the Coniferous Forest. Without this shift, maturity driven by a small group of leaders will remain fragile, and industry competitiveness will stay constrained by the slowest-moving part of the ecosystem.

3.2. Industrial Breakdown of Türkiye's KPI Preferences

In Türkiye, companies tend to prioritize KPIs centered on efficiency and planning. In the short term, this is a rational response to cost pressure, resource constraints, and the need for operational stability. However, it also signals that transformation is progressing along a more defensive path. A strong focus on efficiency and planning can push next-generation competitive factors into the background. These include rapid adaptation to diverse customer demand, security and sustainability. Today's gains may provide near-term operational relief, but they can also weaken resilience over the medium to long term, especially under external pressures such as global regulations, supply chain requirements, and rising customer standards.

Figure 32 | KPI Selection Ratios of the Turkish Industries



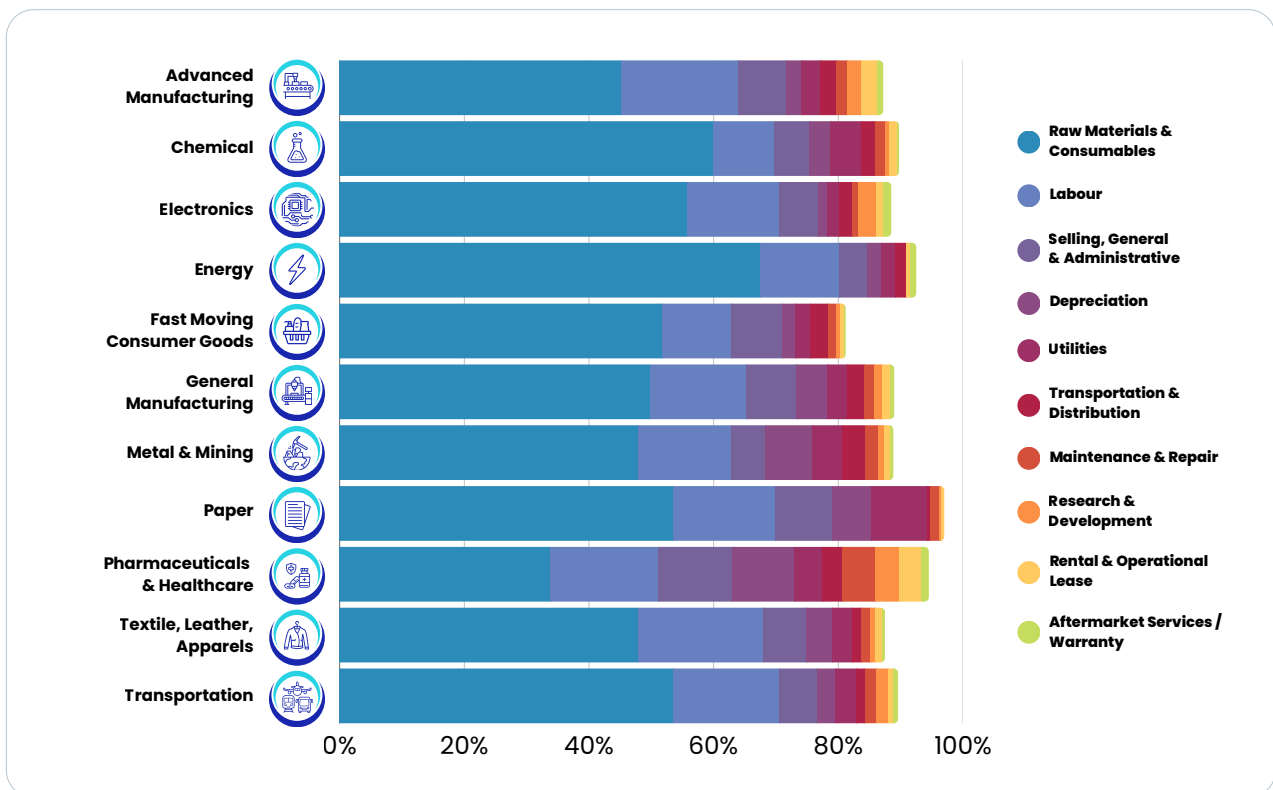
Planning & Scheduling is dominant across almost every industry. This indicates that demand volatility and supply chain disruption are among the main triggers of digital transformation in Türkiye. The broad preference for planning KPIs also suggests that companies prioritize short-term operational stability over longer-term flexibility. Workforce Efficiency is especially prominent in labor-intensive industries, where human capital remains a decisive performance driver. In this context, the development of digital skills will largely determine whether technology investments translate into sustained productivity gains. Asset & Equipment Efficiency stands out in capital-intensive industries such as Chemicals, Transportation, Metal, and Paper.

However, Asset & Equipment Efficiency selection is relatively low in labor-intensive industries such as textiles. In these sectors, companies tend to manage cost pressure through labor productivity rather than through capital-intensive investments such as machinery renewal and line modernization. Production & Workforce Flexibility is also selected less. This suggests that companies prioritize sustaining current line productivity over responding to customer demand variety and rapid changeovers. It is notable that sectors where flexibility is emphasized globally, place less weight on this KPI in Türkiye. Safety & Security is the least selected KPI. While still secondary in Türkiye compared to global trends, these topics may quickly gain priority as regulations and customer requirements tighten.

3.3. Industrial Breakdown of Türkiye's Cost Profiles

Türkiye's industrial cost profiles show a clear pattern. Raw materials and consumables dominate cost structures across most industries. This is especially pronounced in capital- and commodity-intensive sectors such as chemicals, metal and mining, and paper, where the share often exceeds 60%. As a result, global commodity price movements translate directly into cost pressure for the Turkish industry. In contrast, labor-intensive sectors such as textiles, pharmaceuticals, and healthcare stand out with a higher labor cost share. This cost structure helps explain why digitalization efforts in these industries frequently prioritize workforce efficiency, productivity, and stability.

Figure 33 | Türkiye Industrial Cost Profile Breakdown



For general manufacturing and FMCG industries, the shares of SG&A and depreciation are more visible. This suggests that as scale increases, management overhead and asset renewal cycles become more decisive in the cost structure. Utilities, maintenance & repair, and transportation & distribution costs in traditional industries such as paper, metal, and mining, take a relatively larger share. This reflects the structural burden of energy-intensive operations and aging equipment. These sectors, therefore, offer high potential for digitalization to deliver direct financial impact, particularly through preventive maintenance and efficiency gains. Across industries, R&D, leasing, and aftermarket services/warranty remain among the smallest cost items. In SME-heavy industries, their low share relative to turnover suggests that opportunities to build competitive advantage through innovation and stronger after-sales capabilities are still underdeveloped.

3.4. In-depth Analysis of Türkiye's Industries: Dashboards & Insights

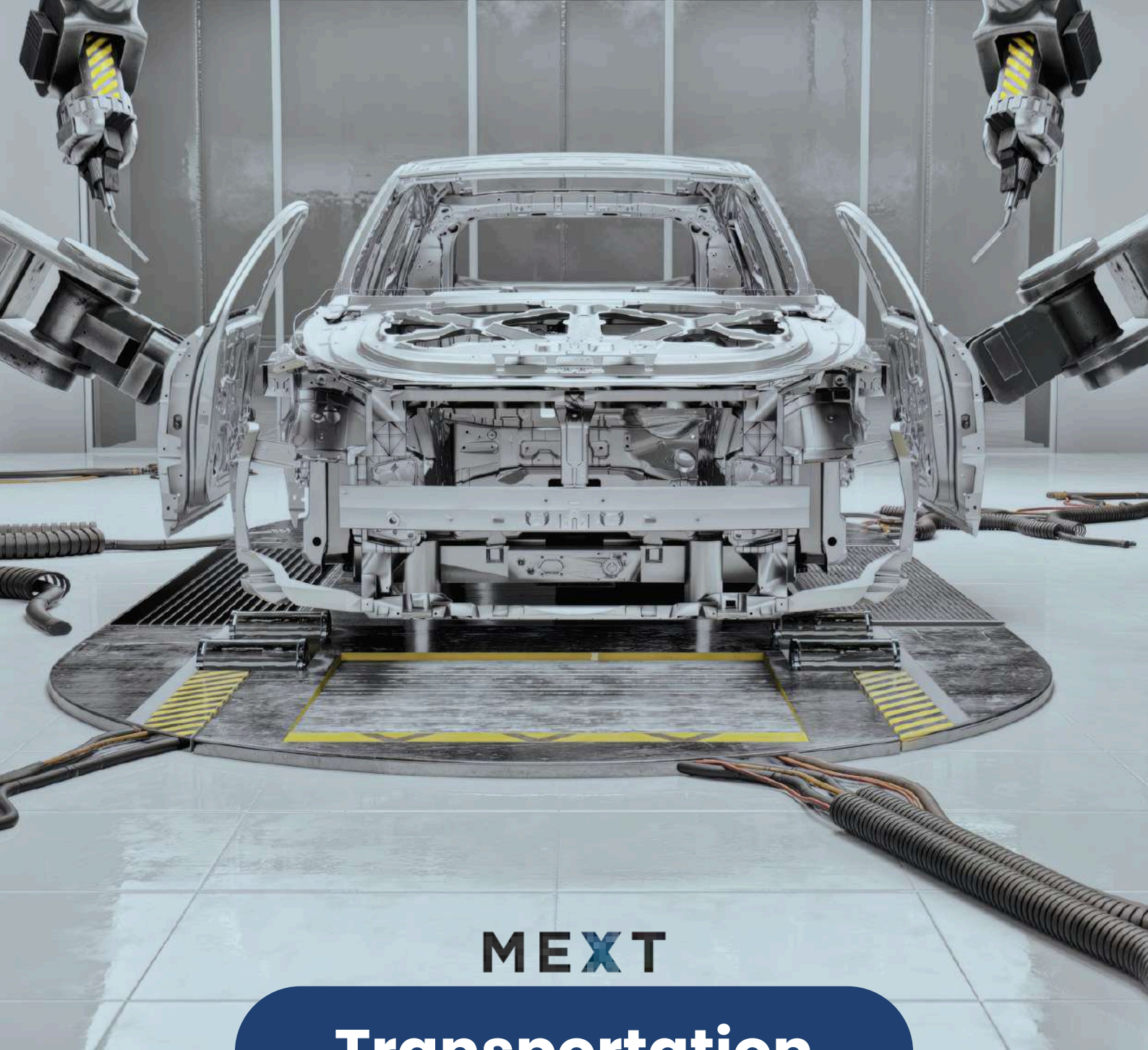
Assessing Türkiye's digital transformation journey solely through cross-industry averages can be misleading. Each industry follows a distinct transformation path shaped by its cost structure, competitive dynamics, supply chain relationships, and capacity to adopt technology. This section provides an in-depth review of 11 major industries through dedicated dashboards. It brings together average digital maturity scores, KPI preferences, cost profiles, and archetype positions to build a clearer picture. The objective is to evaluate each industry not only in terms of where it stands, but also why it stands there and what it can do next to accelerate progress.

Figure 34 | SIRI Industry Clusters



*Utilities Industry was not included in the study due to insufficient data.

This approach adds two layers of value to the report. First, it clarifies the structural challenges and opportunities faced by different industries within Türkiye's broader industrial landscape. Second, it helps policymakers and company leaders target resources more effectively by identifying industry-specific intervention areas. As a result, the roadmap moves beyond an "average Türkiye" view and supports each industry in its own context, while collectively strengthening national competitiveness.



MEXT

Transportation

Industry Insights

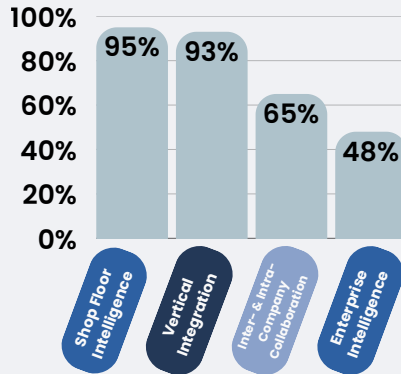
Transportation Industry Dashboard



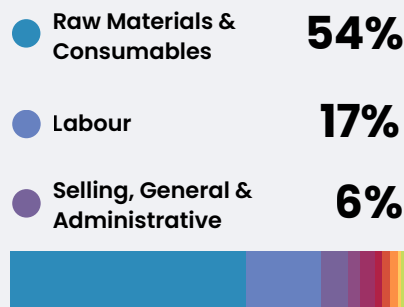
Transportation

SIRI Average Score: **1.52**

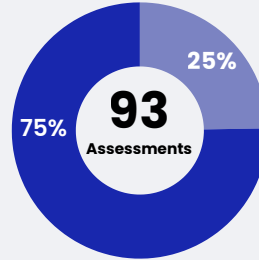
Top Prioritized Dimensions



Top Cost Profile Averages



SME - Large Analysis

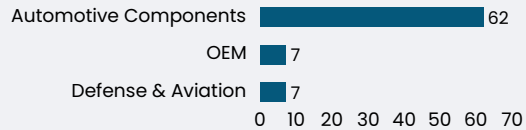


	SME	Large
Process	1.03	1.88
Technology	0.70	1.39
Organization	0.89	1.94
Overall	0.85	1.74

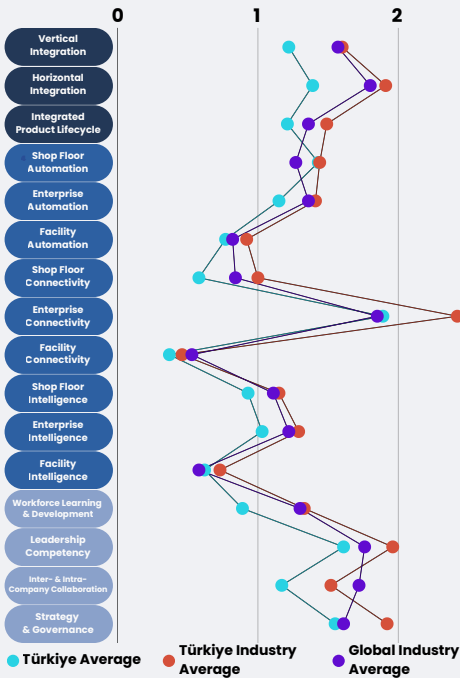
Top KPI Selecting Frequencies

	Planning & Scheduling Effectiveness	Asset & Equipment Efficiency	Workforce Efficiency
Overall	72%	71%	58%
Large	67%	71%	50%
SME	87%	70%	83%

Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	1st	4th
Technology	4th	6th
Organization	4th	8th
Overall	1st	7th

Global Source: INCIT

Initial Findings: Transportation

High Variability in Sub-Industries



Within transportation, digital maturity varies significantly by sub-industry. The automotive ecosystem, shaped by integration into global value chains, tends to adopt more advanced practices in quality management, supply chain integration, and production efficiency. Aviation follows a different trajectory. Progress is more cautious and incremental due to stricter regulation and certification regimes. In aviation, traceability and safety compliance are primary drivers, while speed and flexibility carry less weight. Given this variance, a sub-industry-based approach will be more effective than a one-size-fits-all transformation strategy.

SMEs and Large Enterprises: Two Distinct Digitalization Pathways



SMEs are typically labor-intensive, so planning and workforce efficiency sit at the core of their digitalization agenda. However, limited automation and connectivity constrain scalability. Many SMEs face standardization challenges in manual processes and focus on improving capacity utilization. The high labor share in their cost profiles reinforces this dependency. In practice, their pathway requires “operational excellence” steps that stabilize execution and reduce variability. Large companies, by contrast, are shaped more by raw material cost pressure and the need to meet global OEM expectations. They tend to prioritize horizontal integration and enterprise-level intelligence capabilities, supported by stronger investment capacity. At the same time, capital-intensive production structures can limit flexibility, making adaptability a continuing challenge even at higher maturity levels.

The Importance of the Maturity of Supplier Base



Türkiye’s transportation industry is heavily shaped by the automotive supplier ecosystem, and this structure directly influences digitalization priorities. As companies producing parts, components, and systems operate under OEM-driven requirements, quality, delivery, and cost expectations push the standardization and transparency of shop-floor data. This, in turn, accelerates investments focused on maintenance, efficiency, and operational reliability. Without integration mechanisms such as EDI and JIT, meeting OEM expectations is becoming increasingly difficult. Strengthening these integration capabilities is therefore a prerequisite for sustaining competitiveness across the supplier base.

Barriers to Standards Adoption



Although suppliers face strong quality, delivery, and cost expectations from OEMs, this pressure is often limited to short-term performance outcomes. It does not consistently drive the systematic adoption of digital and process standards across the supplier base. OEM requirements may strengthen areas such as quality reporting and JIT delivery, but they are not sufficient to ensure uniform maturity in broader standards. To reduce fragmentation created by uneven digitalization levels, more comprehensive supplier development programs are needed. These programs should support consistent adoption of structural standards such as APQP, PPAP, and EDI across all supplier tiers. If designed and scaled effectively, they can become a key lever to harmonize maturity, improve integration, and accelerate transformation across the entire industry ecosystem.



Cost Realities: The Requirement for Efficiency Solutions

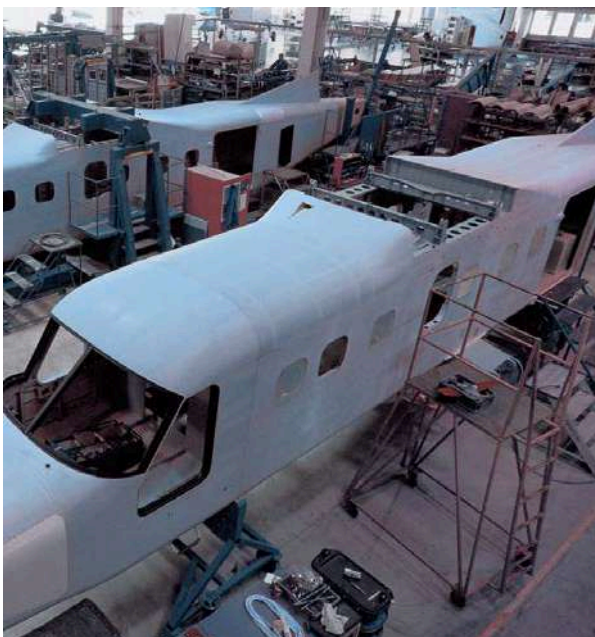


With raw materials accounting for 54% of total costs, improving material efficiency is a strategic necessity. Exposure to global price volatility and supply risks in steel, aluminum, plastics, and electronic components increases vulnerability across the sector. Labor costs (17%) also remain significant, reflecting the continued role of labor-intensive activities, particularly in assembly and welding. This cost structure makes efficiency-oriented solutions unavoidable. Reducing material losses and managing labor and energy consumption more effectively will be central to strengthening competitiveness and resilience.

The Need of Shop Floor Intelligence



Among SME-scale manufacturers, data collection and standardization on production lines remain limited. As a result, analytics-based decision-making is underdeveloped. OEE tracking, downtime analysis, and root-cause analysis on quality issues are often manual or inconsistently recorded, which limits visibility. This gap makes it harder to reduce unplanned downtime and scrap, particularly in manufacturing operations. Strengthening Shop Floor Intelligence can deliver fast impact by improving maintenance effectiveness, process quality, and product reliability.



Production Consistency and Maintenance Discipline



Production lines in the transportation industry are capital-intensive and have a very low tolerance for downtime. In the automotive supplier ecosystem in particular, where downtime costs are highly punitive, maintenance planning and asset management become major leverage points for digitalization. Predictive Maintenance applications and OEE-based monitoring are therefore key drivers of competitiveness, supporting higher uptime, more stable output, and stronger delivery performance.

Supply Chain Synchronization



A defining feature of the industry is its tightly chained production structure. Delays between suppliers and OEMs quickly cascade across the network. For this reason, integration must extend beyond the company boundary and function at an ecosystem level. Real-time demand forecasting, accurate production planning, and production systems that can adapt quickly to change are therefore critical. These capabilities improve delivery performance while helping maintain a healthier inventory balance across the value chain.

Regulatory and Certification Challenges



Regulatory and certification requirements are particularly demanding across several transportation sub-industries. Quality, traceability, and safety standards, therefore, become primary drivers of digitalization. Certification frameworks such as AS9100 and NADCAP increasingly push companies toward more structured digital control systems, strengthening documentation discipline, audit readiness, and end-to-end traceability.



Energy and Emissions Pressure



Although the share of utilities cost appears relatively low, energy-intensive processes such as painting, coating, and heat treatment can materially increase emissions. The larger sustainability risk for Transportation, however, is often not direct (Scope 1) emissions, but indirect (Scope 3) emissions driven by the supply chain and logistics network. Regulatory frameworks such as CBAM and the Green Deal are pushing companies to manage not only their own energy use but also the carbon footprint of suppliers and logistics flows. As a result, the industry should prioritize supply chain emissions reduction strategies alongside plant-level energy efficiency initiatives.



The Need of People: Skilled Workforce Shortage



In SMEs, production remains highly labor-dependent, and shortages of skilled operators keep Workforce Efficiency a top KPI with 82% selection ratio. Strengthening workforce training and digital skills, supported by practical field enablement tools such as digital work instructions and AR-assisted maintenance, is therefore strategically important for easing operational bottlenecks. In parallel, reducing repetitive and low value-added tasks through automation can lift both productivity and job quality. By shifting employees toward more analytical, problem-solving, and process-improvement work, companies can improve performance while supporting engagement and retention.





Transportation Roadmap: Digital Breakthrough

Roadmap for Supplier Network

1

Data Standards and EDI Onboarding: Align tiered suppliers on common data definitions for quality, delivery, and cost. Scale transparency across the full network.

2

Shop Floor Visibility Kits: Make line performance visible within weeks. Quantify OEE, quality and losses. Trigger efficiency improvement actions.

3

Digital Planning & Scheduling Modules: Connect capacity and materials planning to ERP/MRP. Improve response to short-notice demand swings.

4

Lot & Part Traceability Modules: Capture part genealogy and movements via barcode/RFID. Contain defects faster and reduce warranty exposure.

5

Capability Building: Train supervisors and key roles in standard work, problem-solving, and basic data analysis. Reinforce adoption with shared KPIs.

Roadmap for OEM Manufacturers

1

Supplier Integration Backbone: Build a single platform based on EDI and SRM with one data standard for all tiers. Align quality signals and logistics status end to end.

2

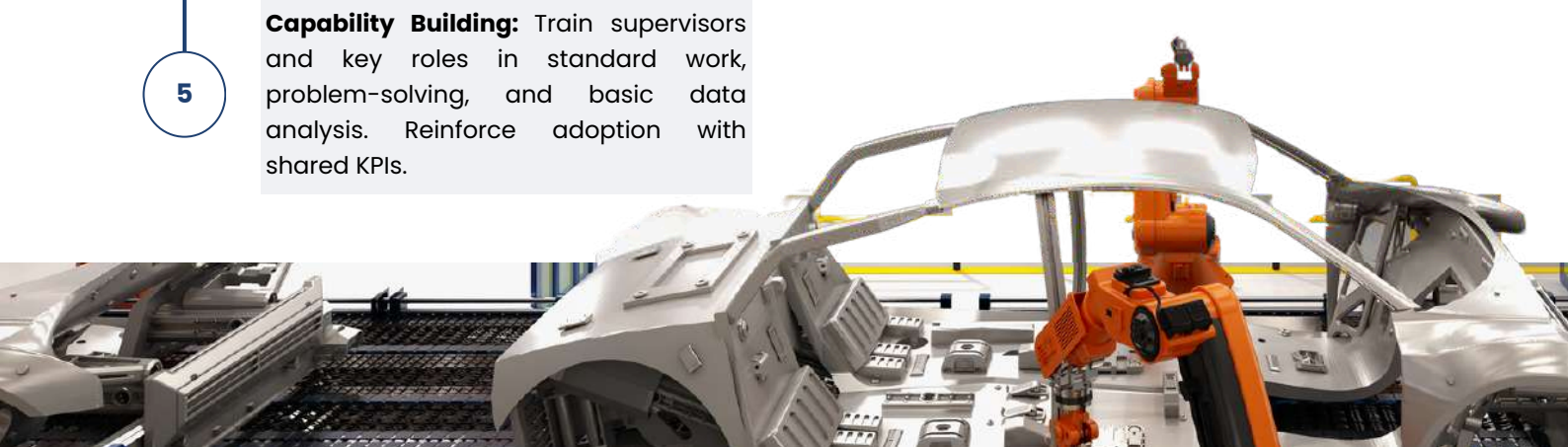
Manufacturing Intelligence at Scale: Detect bottlenecks in body, paint, and assembly in near real time through use of MES and digital twin. Optimize line balance and capacity plans dynamically. Strengthen root-cause analytics, predictive quality, and predictive maintenance. Deploy GenAI where it reduces response time and improves decision quality.

3

Raw Material Loss & Energy Monitoring: Track raw material consumption in real time to reduce waste and prevent losses in energy-intensive processes.

4

Strategic Supplier Development: Uplift strategic suppliers through structured training and audits. Run joint digital projects with shared KPIs and clear benefits tracking.





MEXT

Paper

Industry Insights

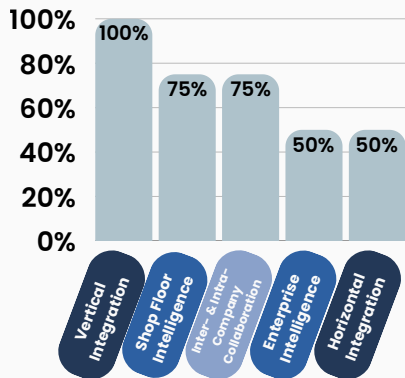
Paper Industry Dashboard



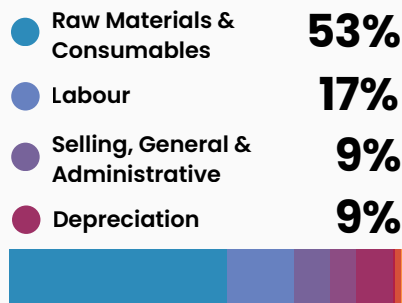
Paper

SIRI Average Score: **1.52**

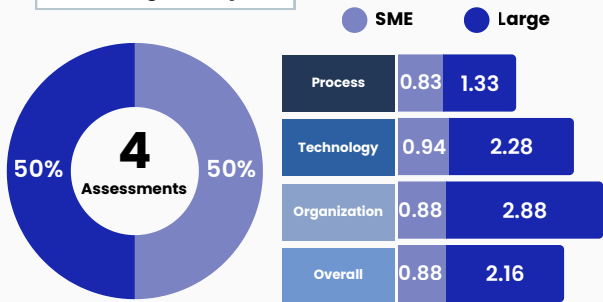
Top Prioritized Dimensions



Top Cost Profile Averages



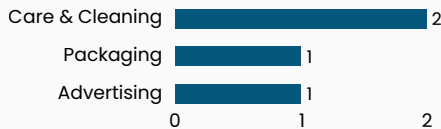
SME - Large Analysis



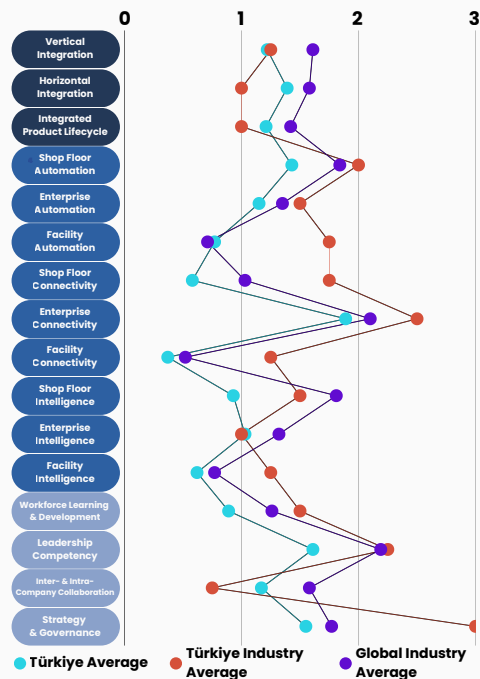
Top KPI Selecting Frequencies

	Asset & Equipment Efficiency	Planning & Scheduling Effectiveness	Time to Delivery
Overall	100%	75%	75%
Large	100%	50%	100%
SME	100%	100%	50%

Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	10th	5th
Technology	1st	5th
Organization	1st	6th
Overall	2nd	5th

Global Source: INCIT

Initial Findings: Paper

Limited Sample, Clear Priorities



Although the paper industry analysis is based on only four companies, the resulting priorities align closely with the sector's structural realities. The findings therefore provide a useful directional snapshot. The industry's capital-intensive asset base, high planning pressure, and sensitivity to delivery performance clearly shape its digital transformation agenda.

Balance Between SMEs and Large Companies



Large companies can fund energy recovery, closed-loop water systems, and advanced maintenance technologies due to stronger capital capacity. SMEs, by contrast, often rely on manual planning and low automation to sustain operations. This gap is clearly reflected in overall maturity scores (SME: 0.88, Large: 2.16). At the same time, SMEs' tighter sensitivity to delivery performance pushes them to prioritize planning and scheduling solutions. The implication is clear: the sector needs differentiated roadmaps by company scale, not a single industry pathway.

Supply Chain Fluctuations: Dependence on Fiber and Cellulose



Dependence on imported cellulose and chemical additives increases exposure to price volatility. SMEs feel this pressure more sharply, while larger companies can mitigate part of the impact through scale and purchasing leverage. As a result, materials efficiency, inventory efficiency, and supply chain integration emerge as priority digitalization areas for the sector.

Different Sub-Segment Orientations



The presence of Care and Cleaning, Packaging, and Advertising sub-segments shows that the paper industry does not have a single, uniform digitalization need. In hygiene products, continuous production and tight quality control are decisive. In packaging, delivery performance and service levels are central. In advertising products, design agility and flexibility pressures are more pronounced. This fragmentation requires sub-segment-specific digitalization scenarios. One-size-fits-all programs will not deliver consistent impact across the sector.

Cost Realities: Heavy Capital Dependency



Raw materials account for 53% of costs, and labor accounts for 17%. SG&A (9%) and depreciation (9%) are also relatively high, reinforcing the sector's capital-heavy profile. This cost mix highlights two priorities: reduce direct production losses and raise the productivity of fixed assets. Sustained profitability in paper depends on tighter control of raw material waste and maintenance-related costs. Improving asset uptime and yield directly protects margins in a high-throughput, low-tolerance operating model.

Depreciation: The Burden of Capital-Intensive Facilities



Paper machines operate over long lifecycles, but their upfront investment is substantial, making depreciation a visible cost driver. In continuous operations, downtime amplifies the impact twice: it reduces output while fixed costs continue to accrue. For this reason, strong maintenance discipline and OEE-focused programs are critical to protecting profitability and reducing the effective burden of depreciation.



Asset & Equipment Efficiency: A Shared Priority



The Asset & Equipment Efficiency KPI is selected by all four companies (both large and SMEs), underscoring the sector's capital-intensive operating model. Breakdowns, maintenance constraints, and capacity losses across large machine fleets are therefore key bottlenecks. This alignment is telling. Improving equipment performance is the clearest first step to raising efficiency and protecting margins across the industry.

The Critical Importance of Planning and Delivery



The high selection of Planning & Scheduling Effectiveness and Time to Delivery indicates sensitivity to raw material supply swings and variability in customer demand. The strong emphasis on planning KPIs among SMEs is especially telling. In this segment, forecasting and scheduling errors translate quickly into higher cost, weaker service levels, and margin erosion.

The Need for Quality and Traceability



In the paper industry, quality issues – especially in packaging and hygiene grades – surface quickly at the customer. Defects such as pinholes, basis-weight variation, or surface non-conformities can trigger immediate rejection risk. The strong selection of Process Quality reflects this pressure. Priority levers include inline sensing, moisture and basis-weight measurement, vision-based inspection, and lot-based traceability. Together, these capabilities tighten process control and shorten containment time when issues arise.

Customer Demand Variations: Pressure on Packaging and Hygiene Products

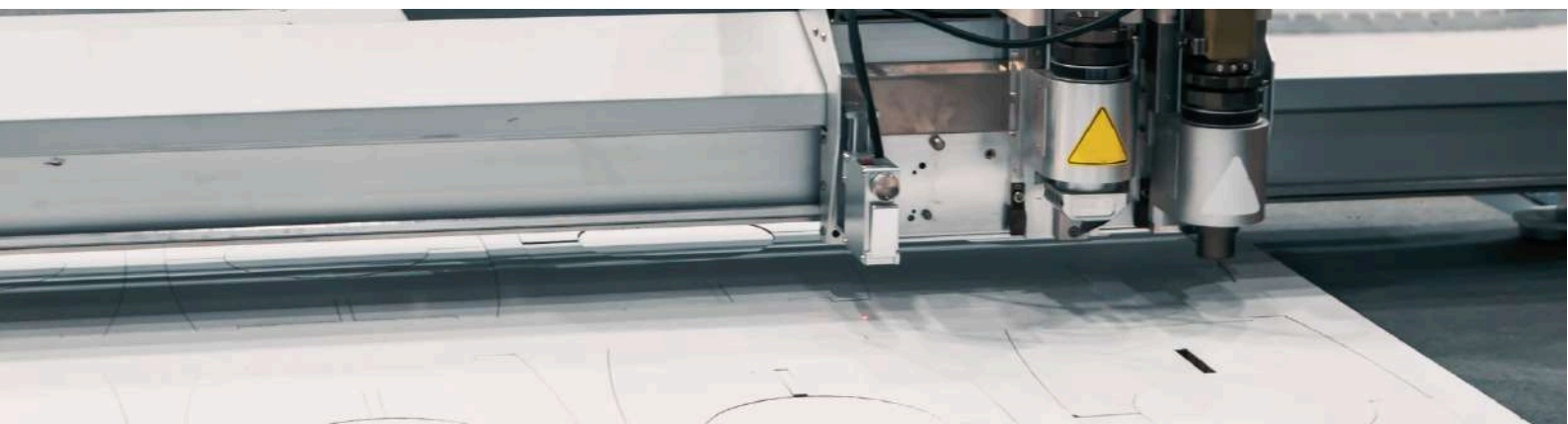


Demand in packaging and hygiene is becoming more complex, with higher product variety and tighter delivery expectations. In packaging, the rise of e-commerce has raised the bar on response time and service levels. In hygiene products, quality and standards compliance have become more decisive. This context explains the strong focus on planning and scheduling KPIs. It also reinforces the need to strengthen demand forecasting and production synchronization across the value chain.

The Critical Impact of Energy and Water Consumption



Paper production is inherently energy and water intensive. Drying lines, steam systems, and continuous rotating equipment drive high-energy loads. Limited water recovery increases both environmental exposure and operating cost. Despite these pressures, the relatively low selection of Utilities Efficiency KPIs suggests that investment in digital measurement and monitoring remains insufficient. This is a missed lever in a sector where energy and water performance directly shape margin and compliance risk.





Paper Roadmap: Digital Breakthrough

1

OEE & Maintenance Analytics Packs: Cut unplanned downtime on machinery and drying sections. Shift from reactive to predictive maintenance. Protect throughput and absorb depreciation pressure.

2

Digital Planning and Scheduling Modules: Improve responsiveness to demand volatility. Align capacity planning and detailed scheduling with ERP/MRP.

3

Lot-Based Traceability: Enable roll, reel, and batch genealogy. Contain weight, moisture, and surface issues faster to reduce rejection and return risk.

4

Energy and Water Monitoring: Track consumption in steam and drying systems in near real time. Improve cost control and sustainability performance. Support closed-loop water recovery where feasible.

Inline Quality Sensing: Embed basis weight, moisture, and surface inspection across the line. Move from end-of-line detection to in-process control. Shorten time to correction.

5

Dynamic Demand Forecasting and Synchronization: Anticipate mix and service-level shifts in packaging and hygiene. Synchronize production and supply planning. Improve delivery reliability.

6

Digital Sales & Order Management: Integrate CRM and ERP for order tracking, pricing, and customer communication. Improve service discipline under high order variability. Reduce overhead through standard workflows.

7

Recipe & Formulation Management: Digitize grades, coatings, additives, and color recipes. Enable faster variants with tighter control. Improve data consistency between R&D and production, and shorten time-to-launch.

8





MEXT

Energy

Industry Insights

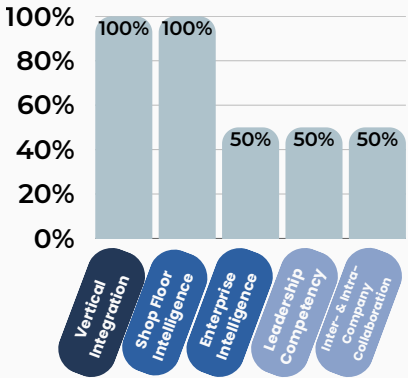
Energy Industry Dashboard



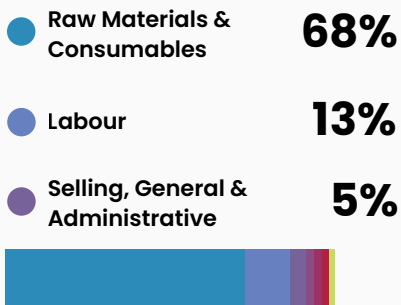
Energy

SIRI Average Score: **1.40**

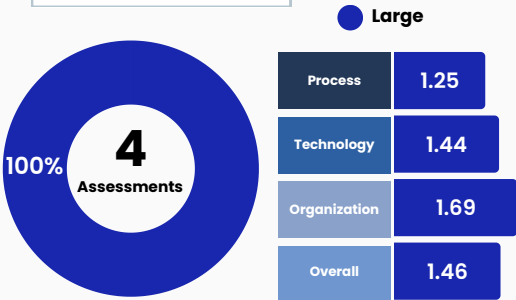
Top Prioritized Dimensions



Top Cost Profile Averages



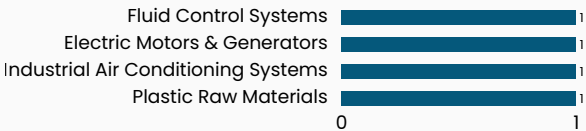
SME - Large Analysis



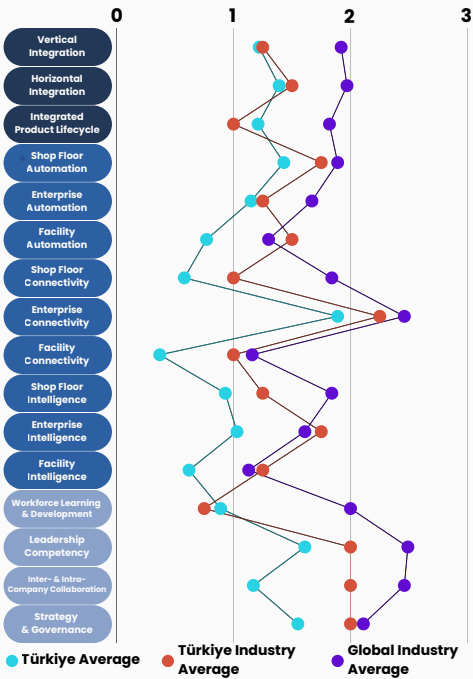
Top KPI Selecting Frequencies

	Workforce Efficiency	Planning & Scheduling Effectiveness	Time to Delivery	Process Quality
Overall	100%	100%	75%	75%
Large	100%	100%	75%	75%

Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	5th	1st
Technology	2nd	1st
Organization	3rd	1st
Overall	4th	1st

Global Source: INCIT

Initial Findings: Energy

Infrastructure and Project-Oriented Structure



High fixed investment and long-duration infrastructure projects make Asset & Equipment Efficiency and Utilities Efficiency fundamental for the energy sector. These levers directly affect operational continuity, cost control, and project returns. Despite this, companies select them as relatively low-priority KPIs, indicating a clear gap between value at stake and performance focus.

Capital Intensity & Depreciation Rate



The energy sector is structurally capital-intensive. Core operations depend on large assets such as generators, motors, transmission infrastructure, and facility installations, which creates a high fixed-investment threshold. Yet depreciation at 2.25% of revenue suggests a portfolio dominated by long-lived assets with extended amortization profiles. Replacement cycles are therefore less frequent, and annual depreciation pressure appears relatively muted. This dynamic helps explain why Asset & Equipment Efficiency is selected at only 25%. Many companies treat asset durability as “given” and prioritize other KPIs such as planning, delivery performance, and labor productivity. The risk is that low depreciation can mask high operational exposure. In energy, an unexpected failure can create outsized opportunity costs and continuity risks. Digital maintenance planning, condition monitoring, and predictive maintenance can turn this structure into an advantage. They extend asset life, reduce unplanned outages, and improve reliability. Over time, asset performance shifts from a hygiene factor to a source of competitive differentiation.

Risk of Imported Inputs in Energy Equipment

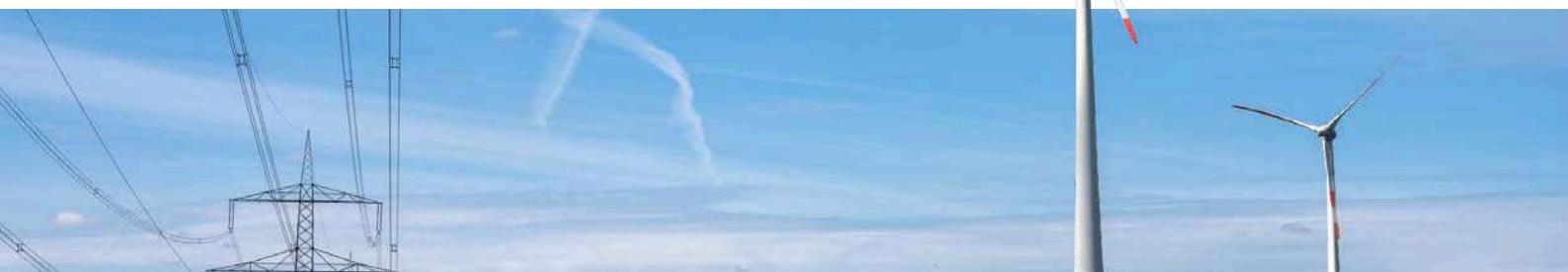


Raw materials and consumables are the dominant cost drivers in the energy sector. Critical equipment such as engines, generators, control systems, and network components is often sourced from abroad, increasing exposure to global price volatility and supply risk. Digitalization can reduce this vulnerability through two levers. First, strengthen integration across the domestic supplier network. Second, increase end-to-end supply chain visibility. Together, these moves help dampen cost fluctuations and lower strategic dependency over time.

The Strategic Importance of the Workforce Factor



Although labor is not a large share of total cost in the energy sector, the fact that Workforce Efficiency is prioritized by all companies highlights a key reality. People are concentrated in high-risk roles such as field operations, maintenance, and safety. In these environments, small errors can translate into major costs, outages, and safety consequences. This makes the workforce a “small cost item, high impact lever.” Productivity matters, but so do competence, discipline, and safe execution, because they directly protect continuity and reliability.



Delivery Risks



In energy projects, delivery delays create more than financial loss. They can trigger contractual penalties, regulatory exposure, and reputational damage. Digital project management, real-time tracking of material and equipment shipments, and digitized approval workflows are therefore critical risk controls. These capabilities strengthen coordination between site and headquarters. They also surface schedule risk early and improve on-time delivery performance.

The Potential of Digital Twins in Critical Processes



In critical processes, small deviations can escalate quickly when parameters such as temperature, pressure, and flow rate shift in real time. Despite this risk profile, adoption of digital twin technology remains limited. When simulation-based digital twins are deployed, they strengthen predictability in both process safety and maintenance planning, enabling earlier intervention and more controlled operations.

Neglected Maintenance and R&D



Notably, Maintenance & Repair and R&D appear almost negligible in the cost profile. This suggests two patterns. Maintenance is often embedded in the broader investment cycle rather than managed as a visible capability area. R&D spend also remains limited, which slows the development of differentiated solutions and local know-how. Targeted investment in predictive maintenance, energy efficiency, and in-house technology development can reshape the cost curve over time. It can also reduce external dependency and strengthen operational resilience in the medium term.

Consistency Over Quality Prevails



The fact that Process Quality is selected by 75% of respondents signals a focus on consistency and continuity, rather than quality in the classical manufacturing sense. In the energy sector, even a one-hour outage can impose substantial economic cost. Operational continuity therefore outweighs most other performance concerns. This has a clear implication for digitalization priorities. Capabilities such as predictive maintenance, smart sensing, and fault prediction should be treated as necessities that protect reliability, not as optional add-ons.





Energy Roadmap: Digital Breakthrough

1

Digital Planning and Delivery Management: Integrate planning, forecasting, and project controls to reduce schedule slippage. Improve regulatory compliance and delivery reliability on large projects.

2

Smart Sensors & Energy Continuity Analytics: Strengthen supply reliability by expanding real-time sensing across critical assets and network nodes, and converting signals into actionable alarms through fault prediction and anomaly detection. Shift from reactive response to early-warning operations by monitoring key parameters, identifying deviation patterns, and triggering intervention before service impact occurs. This improves continuity, reduces outage duration, and supports more stable operating performance.

3

Supplier Integration Platforms: Increase the visibility of local manufacturers with digital chain solutions, reducing dependence on external sources for engines, generators, and network components. The impact of global price fluctuations and delivery risks is minimized thanks to the visibility of the local supply chain.

4

Safety and Security: Strengthen field execution with digital safety controls, including computer-vision analytics on CCTV where appropriate, and targeted digital and on-site training. Embed cybersecurity awareness as a core operational discipline across both IT and OT environments.

Enterprise Wide Performance Analytics

Platform: Eliminate data silos at the Enterprise Intelligence layer by integrating demand forecasts, network loads, asset health and maintenance data, outage records, and financial performance into a single BI and advanced analytics backbone. Improve the accuracy and governance of planning and delivery KPIs with consistent definitions and automated reporting. Use advanced analytics to anticipate outage risk, stress-test scenarios, and prioritize interventions based on reliability impact and cost.

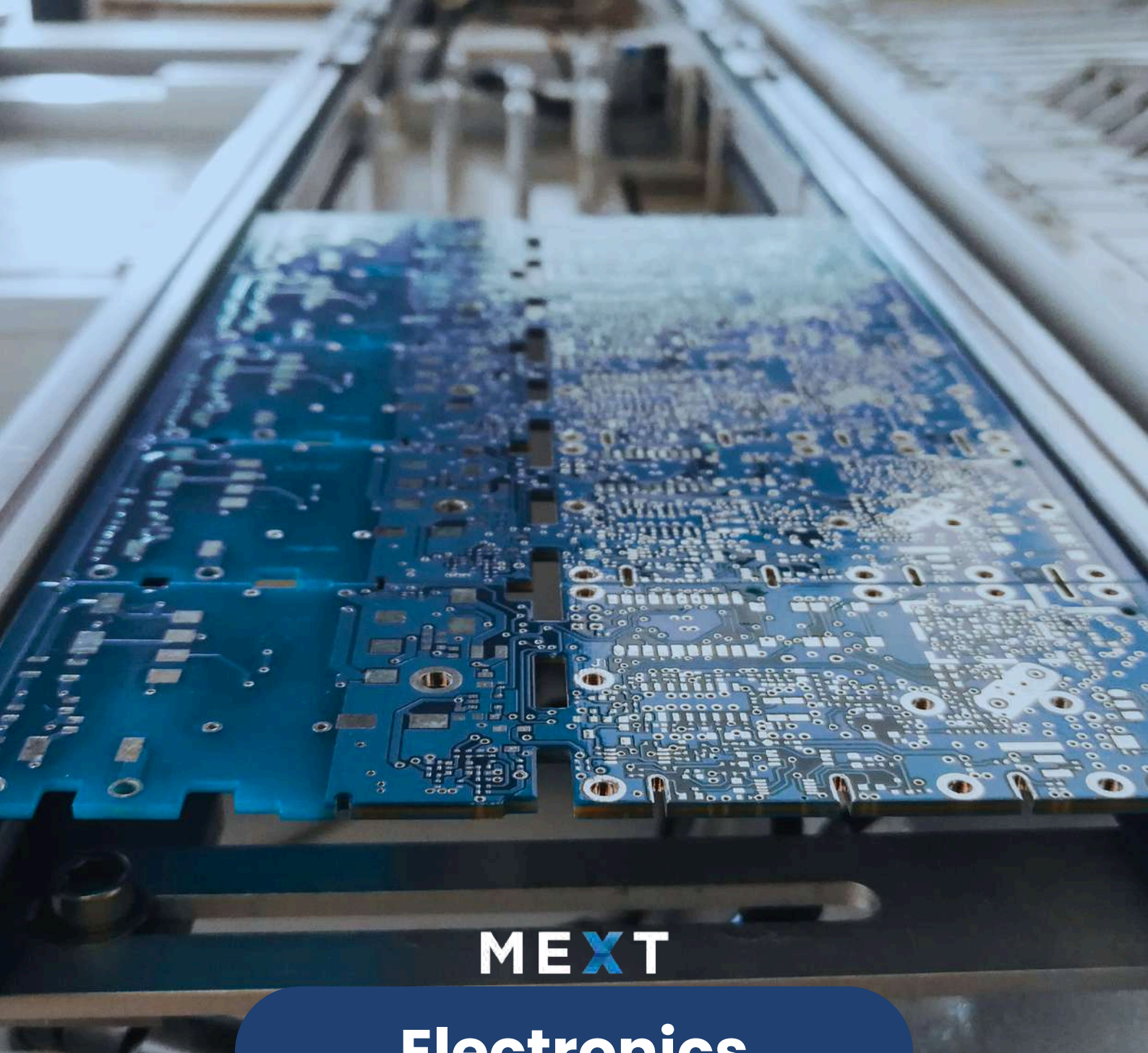
5

6

Digital Leadership & Strategy Platform:

Built for senior energy leaders, this dashboard consolidates key signals – regulatory exposure, project schedule risk, and supply security – into a single executive view. It enables real-time tracking of strategic priorities and a tighter linkage between long-term investment choices and operational realities. By creating a clear management rhythm and accountability, it reduces the “vision-to-execution” gap and strengthens Leadership Competency.





MEXT

Electronics

Industry Insights

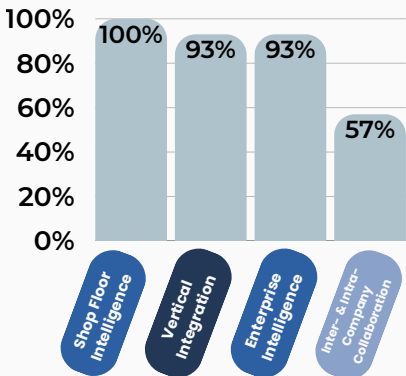
Electronics Industry Dashboard



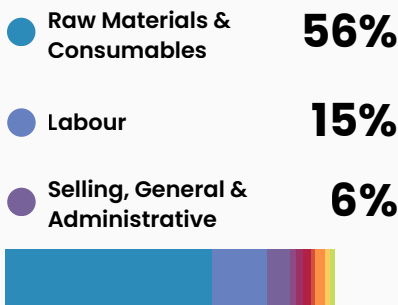
Electronics

SIRI Average Score: **1.46**

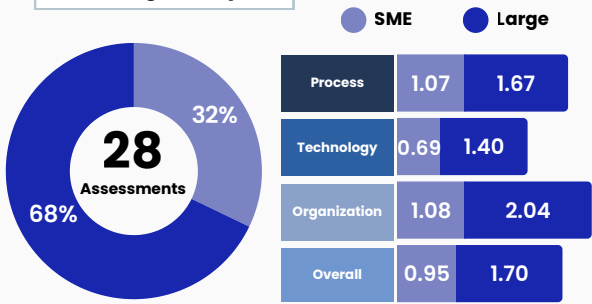
Top Prioritized Dimensions



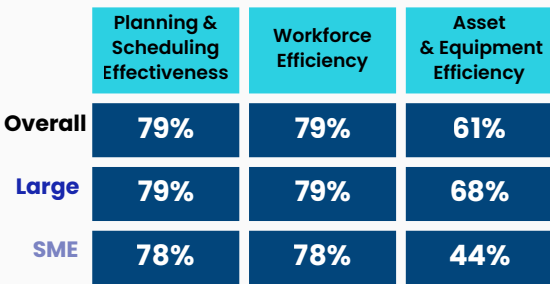
Top Cost Profile Averages



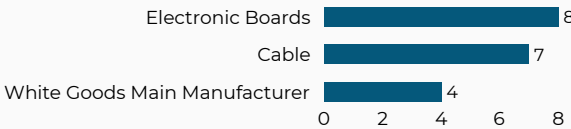
SME - Large Analysis



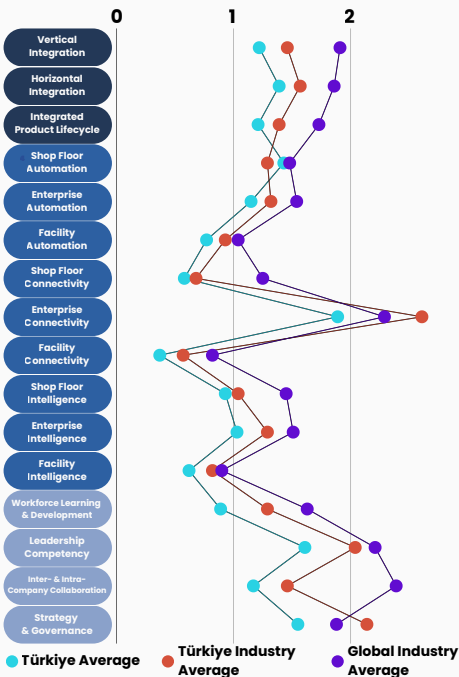
Top KPI Selecting Frequencies



Most Common Sub-Industries

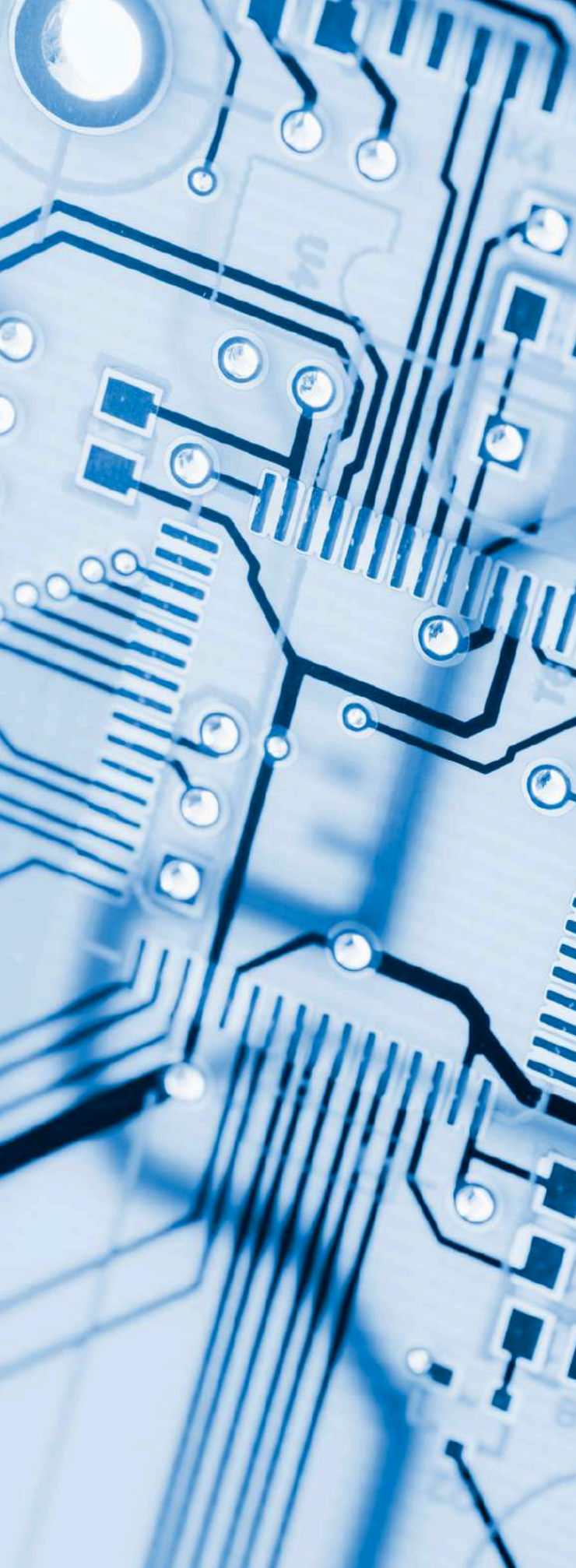


Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	2nd	2nd
Technology	4th	4th
Organization	2nd	2nd
Overall	3rd	2nd

Global Source: INCIT



Initial Findings: Electronics

Current Status in Electronic Sub-sectors



The electronics industry is structurally fragmented. Sub-segments such as electronic cards and PCB manufacturers, consumer electronics and white goods, cables, motors and generators, and HVAC systems follow distinct digitalization paths. The highest average maturity sits in consumer electronics and white goods (2.64). The OEM role and export exposure have accelerated supply chain integration and standards compliance. PCB and electronic card manufacturers also face strong pressure to adopt quality and traceability requirements due to direct links to global value chains. Cable manufacturers, in contrast, tend to channel digital investment toward efficiency and cost optimization, reflecting intense price competition and margin pressure.

Horizontal Integration: Isolated Connections with the Main Industry



Large OEMs in electronics are typically well integrated into global value chains. Local SME suppliers, however, often struggle to meet the same integration requirements. The resulting gap in Horizontal Integration limits SMEs' ability to comply with OEM expectations and weakens the chain across the supply network. External shocks amplify this fragility. Disruptions such as the global chip shortage expose the risks of import-heavy dependency in semiconductors and other critical components, leading to planning instability, delivery delays, and customer pressure. For the sector, stronger digital data-sharing platforms, supplier integration, and inventory visibility are no longer "efficiency upgrades." They are strategic necessities for supply assurance, resilience, and long-term competitiveness, supported by structured alternative sourcing capabilities.

SME – Large Split: Two Different Digitalization Pathways

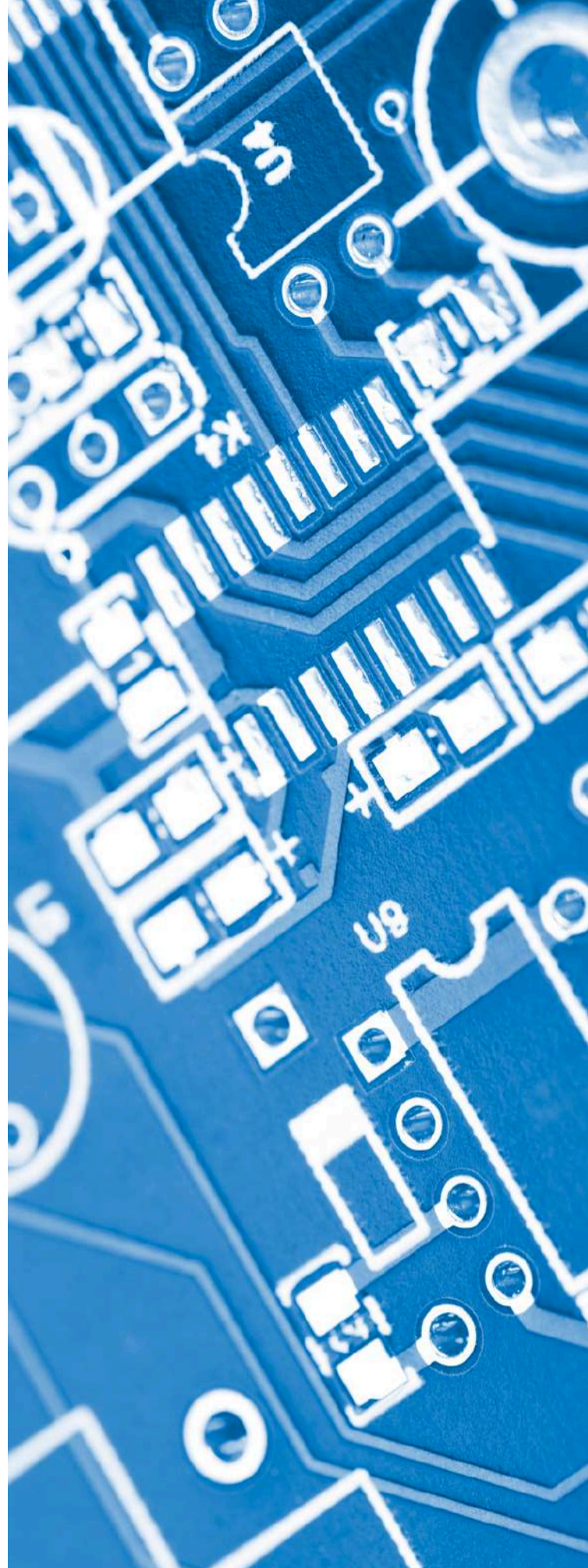


The average maturity of SMEs in electronics remains at 0.95, while large companies reach 1.70. This gap points to two fundamentally different transformation paths. SMEs often depend on labor-intensive assembly and manual testing, which limits automation, integration, and structured data capture. As a result, capacity swings, delivery uncertainty, and quality variability remain common. Large companies, by contrast, are more tightly linked to OEMs and global value chains. They tend to strengthen execution through ERP–MES alignment, EDI-based supplier connectivity, and higher automation depth. This allows them to turn quality and traceability into a competitive differentiator rather than a compliance burden.

Cost Profile: Complex Input Structure and Process Dependency



Raw materials account for 56% of the electronics sector's total costs, placing it among the most input-dependent industries. This exposure is also uneven by sub-segment. In PCB production, copper foils, solder alloys, and chemical processes are major cost drivers. In cables, copper and aluminum dominate. In white goods and motor production, magnets, steel, plastics, and injection-molded parts become critical. This structure increases sensitivity to global metal price swings and supply disruptions, including semiconductor shocks. Labor costs rise sharply where automation is limited, especially in assembly, testing, and quality control. SMEs are particularly exposed due to hands-on work such as soldering, harness preparation, and device testing. Large companies, by contrast, shift toward a more material-heavy cost profile as scale increases. This pushes them to invest in material efficiency and supply chain transparency. The implication is a dual transformation need. Electronics requires both automation to stabilize labor-intensive steps and supply chain analytics to manage raw material volatility and availability risk.



Lack of Traceability in Quality Management



In electronics, even micro-scale defects can cause system-level failure. Despite this, the lower-than-expected selection of the Process Quality KPI suggests that quality performance is not consistently prioritized at the KPI level, despite its operational and customer impact. This gap between awareness and execution is most visible among SMEs. Scaling traceability is one of the most direct levers to close this gap. It improves containment speed, reduces warranty exposure, and protects customer trust by enabling faster root-cause identification and corrective action.

The Paradox in Delivery Performance



Delivery speed is a critical factor in electronics, yet Time to Delivery receives relatively low priority. This creates a clear mismatch between market requirements and KPI focus. For PCB and cable suppliers, on-time delivery is a decisive performance metric in global OEM and assembly chains, where even short delays can disrupt downstream production. White goods manufacturers face similar pressure. They must execute high-volume, high-variant programs with rapid market response. Despite this reality, KPI emphasis skews toward internal efficiency and cost, which can push customer-facing delivery performance into the background. This risk is rising as e-commerce compresses lead-time expectations and increases variability. To sustain competitiveness, KPI sets need to link internal efficiency to customer outcomes more directly. Time to Delivery should be treated as a strategic performance indicator, not only an operational metric.



Dependence on Planning and Human Resources



In electronics, Planning & Scheduling Effectiveness and Workforce Efficiency rank highly, reflecting the operating reality of complex, variable production. In PCB manufacturing, capacity is constrained by bottlenecks at critical steps. In cables, shift patterns and order-driven cutting and winding schedules directly shape delivery performance. In white goods and motor assembly, high product variety further increases planning complexity. Companies, therefore, lean on scheduling discipline and labor productivity to keep daily execution stable. The risk is that planning stays reactive. Many companies optimize “today’s plan,” but do not build forward-looking capacity scenarios. This reinforces a cycle of reactive digitalization rather than proactive control. The SME segment is particularly exposed. Manual labor dependency is visible in the absence of Production & Workforce Flexibility as a selected KPI, even though demand variability is rising. Limited flexibility becomes a constraint when customer mix shifts or demand spikes. The implication is clear. Planning needs to move beyond scheduling. It should be complemented with demand forecasting, capacity simulation, and workforce flexibility scenarios that enable faster, more resilient responses under volatility.

Opportunity to Strengthen Innovation



The cost profile shows that R&D spend remains limited. It is relatively higher among SMEs, yet still small in absolute terms, and it is near-negligible among large companies. SMEs can generate innovation in niches such as PCBs, sensors, or specialized components. However, these efforts often stay localized and do not scale, limiting sector-wide impact. Scaling R&D is therefore critical, not only for new product development but also for building differentiated technologies for global markets. Priority opportunity spaces include energy-efficient components, higher-durability cable and motor systems, smart home platforms, and IoT-enabled devices.



Electronics Roadmap: Digital Breakthrough

1

Digital Supplier Collaboration Platform: Build a tiered collaboration layer that brings cable, plastic, and electronic component suppliers onto a common cadence. Use standardized delivery and quality signals to reduce scraps. Strengthen Horizontal Integration and Inter- & Intra-Company Collaboration, and reduce Time to Delivery risk through shared milestones and exception management.

2

MES-SMT Integration: Connect SMT placement, reflow, AOI/AXI, and functional test stations to MES/ERP so losses are visible in one place. Link scrap, rework, downtime, and maintenance events to product and line context. Improve response speed to recurring defects and chronic stops. Lift Shop Floor Intelligence and Shop Floor Connectivity, and improve Asset & Equipment Efficiency through higher availability and faster root-cause closure.

3

Smart Planning & Demand Simulation System: Move from schedule execution to proactive planning. Combine demand forecasting with capacity and constraint simulation to anticipate bottlenecks and stabilize commitments.

4

Advanced Quality and Traceability: Establish batch and serial genealogy that connects components, process parameters, and test results. Integrate QMS and MES to create a single quality record and faster containment paths. Reduce warranty exposure and improve audit readiness for export markets. Strengthen Process Quality by turning traceability into a prevention and learning mechanism, not only a compliance tool.

Energy and Resource Efficiency

Analytics: Focus measurement where value is highest. Monitor reflow oven profiles, chemical bath consumption in PCB lines, and energy consumption of injection molding machines in near real time. Track consumables waste, yields, and rework drivers to protect margins under high input exposure. Link resource analytics to quality outcomes to reduce both cost and sustainability risk.

5

R&D & Product Lifecycle Innovation

Platform: Use PLM to run the full loop from design to prototype, validation, and ramp-up. Make engineering changes, test evidence, and customer feedback traceable and searchable. Improve revision control and reduce "engineering-to-production" disconnects. Strengthen Integrated Product Lifecycle and reinforce Inter- & Intra-Company Collaboration across engineering, production, quality, and suppliers.

6

Digital Operator Training Platform:

Reduce operator error rates in processes such as SMT assembly lines, soldering ovens, and functional test stations through AR-based digital work instructions, guided checks, and maintenance. Reduce operator-dependent variation in placement, solder quality, and test procedures. Improve first-pass yield and stabilize output, strengthening Workforce Efficiency and reducing rework loops.

7



MEXT

Chemical

Industry Insights

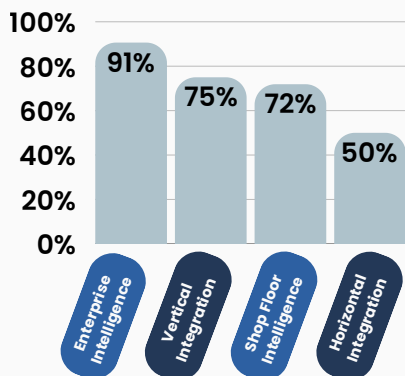
Chemical Industry Dashboard



Chemical

SIRI Average Score: **1.29**

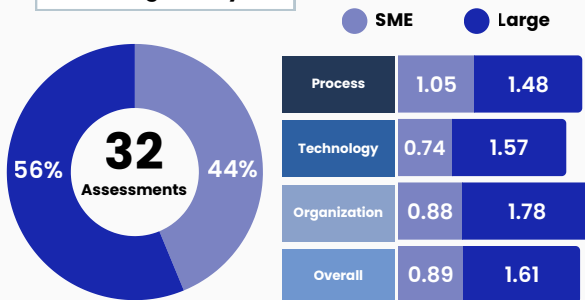
Top Prioritized Dimensions



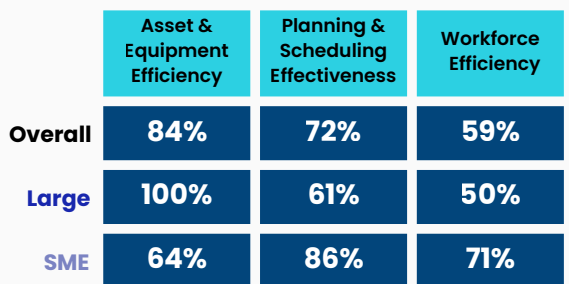
Top Cost Profile Averages



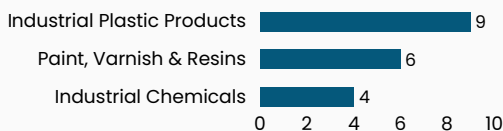
SME - Large Analysis



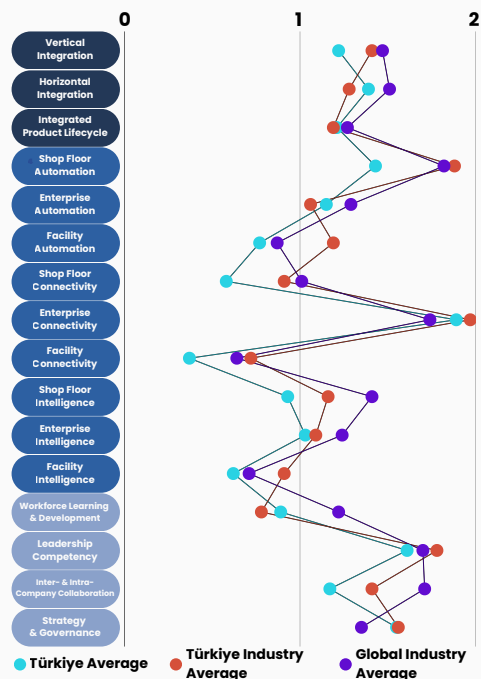
Top KPI Selecting Frequencies



Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	3rd	8th
Technology	3rd	6th
Organization	7th	9th
Overall	6th	9th

Global Source: INCIT

Initial Findings: Chemical

Sub-Sector Differentiation



Despite high regulation and environmental exposure, the chemical industry's average maturity (1.29) is lower than expected. The reason is structural fragmentation. Digital maturity varies sharply across sub-sectors. Synthetic fibers and polymers (2.19) and plastic raw materials and granules (1.91) sit well above the average. Industrial plastic products and injection molding (1.07) and fertilizers and agricultural chemicals (0.61) remain at the low end. Continuous-process, large-scale segments (fibers, polymers, petrochemicals) typically advance faster due to global competition, stronger compliance requirements, and higher capital capacity. SME-heavy, batch-oriented segments (injection molded plastics, paint and varnish, fertilizers) tend to lag. They are shaped by domestic demand, price-based competition, and limited automation. This variance is the sector's core bottleneck. Large producers progress with a compliance, sustainability, and customer-driven agenda. Smaller players are constrained by short-term cost pressure and weaker infrastructure, and often still treat digitalization as an expense rather than a performance lever.

Workforce Efficiency



Labor represents 10% of the total cost in the chemical industry. Yet, Workforce Efficiency KPI selection ratio remains prominent (59%) because safety and process continuity depend on disciplined execution in high-risk environments. Among SMEs, Planning & Scheduling Effectiveness (86%) and Workforce Efficiency (71%) are the leading KPI choices. The pattern is consistent: as scale decreases, penetration of automation in processes typically falls, and performance depends more on workforce-led process control and day-to-day planning stability.

Supply Chain Fluctuations: Petrochemical Dependency

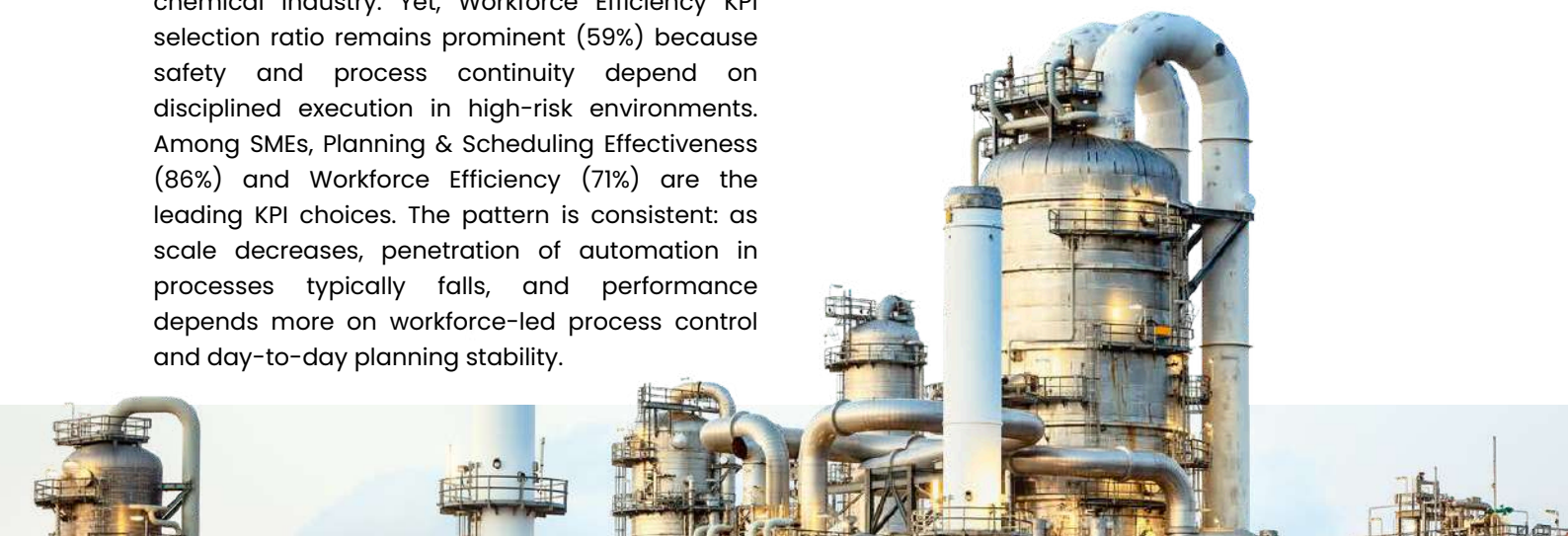


In chemicals, Raw Materials and Consumables costs account for 60% of the total. This makes margins - especially in petrochemical-linked and import-dependent sub-segments - highly sensitive to global commodity price swings and supply shocks. To reduce vulnerability, three levers stand out: diversify and qualify alternative sources, optimize inventory policies, and strengthen demand forecasting and planning. Together, these moves improve supply assurance, dampen cost volatility, and stabilize profitability under external turbulence.

Environmental Performance and Sustainability Gap



Chemical plants are inherently resource and emissions-intensive. High energy and water consumption, emissions, and waste generation are structural realities of the operating model. The relatively higher Utilities cost category share compared with many other industries signals that this is not only a cost driver, but also a material sustainability and compliance risk. As a result, investment in digital monitoring and analytics is becoming non-negotiable. IoT-based energy and water tracking, waste and yield recovery visibility, and carbon footprint analytics are critical to improve cost control and meet rising ESG expectations.





Equipment Efficiency is Critical for Large Companies



All large companies in the sector prioritize Asset & Equipment Efficiency in KPI selection, reflecting the economics of continuous operations. Minimizing downtime on reactors, distillation columns, and critical process lines is decisive for throughput and unit cost. At the same time, the cost profile reveals a tension. Depreciation is meaningful (notably above 7% in SMEs), yet Maintenance & Repair remains low at 1.7%. In effect, assets are being consumed, but maintenance capability is not being built at the same pace. Over time, this imbalance can increase failure risk and reliability exposure, especially without stronger preventive and digitally enabled maintenance practices.

Lack of Process Automation



Even in large-scale facilities with high-capacity reactors, mixers, distillation, and polymerization lines, process control often remains semi-automated. This leaves operations sensitive to disturbances and increases variability, especially where Shop Floor Intelligence and Shop Floor Automation maturity are limited. The biggest step-change levers are clear: stronger real-time process control, predictive process models, and tighter SCADA-MES integration. Together, these capabilities reduce variance, improve yield, and raise overall equipment effectiveness in continuous and batch environments alike.

Data Fragmentation and Lack of Digital Standards



In many chemical companies, laboratory data, process data, and quality test results sit in separate systems or manual spreadsheets. This fragmentation limits standardization, slows root-cause analysis, and constrains advanced analytics. Integrating production and quality data with a digital LIMS backbone can close this gap. It improves traceability, shortens deviation investigations, and enables more systematic process optimization through consistent, end-to-end data.

The Potential of Digital Twins in Critical Processes



In chemical operations, small deviations can escalate quickly when reactor temperature, pressure, or flow shifts in real time. Despite the high-risk profile, adoption of digital process twin technologies remains limited. Simulation-based digital twins can materially change this. They improve predictability in process safety and enable more proactive maintenance planning by validating scenarios, anticipating excursions, and supporting earlier intervention.

The Need for Supplier Development



SME-scale suppliers are critical in chemicals, especially for raw materials, additives, and specialty inputs. Yet quality and delivery performance can be uneven, which increases variability and risk for downstream producers. Structured supplier development programs with a strong digital foundation can close this gap. By aligning SME suppliers to consistent quality, delivery, and sustainability expectations, large manufacturers can push standards deeper into the supply base and improve reliability across the value chain.

Integration of Product Lifecycle & Regulatory Compliance



Frequent changes in environmental standards and evolving customer requirements – especially in specialty chemicals, paints, and resins – make disciplined product lifecycle management increasingly important. Yet PLM adoption remains limited. Digitally integrating product development with regulatory controls can close the gap. It accelerates change management, improves compliance readiness, and shortens time to market by reducing rework and approval delays.





Chemical Roadmap: Digital Breakthrough

1

SCADA-MES Advanced Process Control and Cybersecurity: Expand real-time monitoring and predictive control across reactors, distillation, and polymerization units through SCADA-MES integration. Strengthen Shop Floor Intelligence and improve Asset & Equipment Efficiency by reducing variability and unplanned downtime. Embed OT cybersecurity layers to protect availability and integrity, and reduce exposure to unauthorized access and data manipulation.

2

Digital Supplier Integration Program: Bring SME suppliers of additives, solvents, and specialty inputs onto an EDI-enabled collaboration platform. Improve delivery reliability and strengthen Horizontal Integration. Position Time to Delivery as a strategic advantage through shared milestones, exception handling, and supplier performance visibility.

3

Digital Supply Chain and Demand Forecasting Platform: Combine demand forecasting, inventory optimization, and supplier performance analytics on top of ERP/MRP. Reduce volatility driven by petrochemical and import dependency. Strengthen Planning & Scheduling Effectiveness and reinforce Inter- & Intra-Company Collaboration through shared planning cadence and clearer decision rights.

Digital Laboratory and Process Data Integration: Consolidate laboratory results, process parameters (temperature, pressure, flow), and quality outcomes into a single, governed data layer. Improve Enterprise Intelligence, strengthen Process Quality, and shorten product development cycles by accelerating deviation analysis, traceability, and change control.

4

IoT-Based Energy and Resource Efficiency Analytics: Track energy, water, and material losses in near real time across distillation columns, polymerization reactors, and solvent recovery lines. Reduce utilities and raw material pressure while strengthening Enterprise Intelligence through consistent measurement and analytics. Scale IoT with strong data governance and facility security protocols to keep sustainability programs resilient.

5





Chemical Roadmap: Digital Breakthrough

6

Digital Equipment Management and Preventive Maintenance : Strengthen Asset & Equipment Efficiency by scaling condition monitoring and predictive maintenance across reactors, distillation columns, and mixing lines. Use IoT sensing and asset-health models to detect degradation early and intervene before drift becomes a shutdown. Standardize critical-equipment strategies and spares policies to reduce chronic downtime and stabilize throughput.

7

PLM—Production Data Bridge for Product Lifecycle Management: Run new formulations, eco-products, and resin and paint programs from prototype to ramp through a PLM backbone. Connect PLM with production and quality data to improve change control, first-time-true scale-up, and compliance documentation. Strengthen Integrated Product Lifecycle and Inter- & Intra-Company Collaboration, and shorten development cycles by reducing rework and approval delays.

Facility Security & Emergency Management System:

Implement sensor-based detection & automated warnings for gas leaks, temperature spikes, pressure imbalance, and fire risk. Integrate SCADA signals, safety sensors, access control, and fire systems into a single incident dashboard with clear escalation paths. Digitize emergency procedures and drill management to improve response discipline. Reduce response time and strengthen safety & reliability while protecting asset integrity and business continuity.

Process Safety with Digital Twin: Use digital twins to simulate excursions, test operating envelopes, and validate abnormal situations for high-pressure, high-temperature units. Convert learnings into operating guidelines and alarm strategies. Improve predictability in maintenance planning and strengthen Shop Floor Intelligence, while lifting safety & reliability through earlier intervention and better scenario readiness.

8

9

Digital Operator Competency Program:

Deploy AR work instructions, digital safety simulations, and virtual training guides to reduce operator-dependent variation. Focus on high-risk tasks such as charging, sampling, cleaning, and changeovers. Reinforce adoption with role-based certification and refresh cycles. Improve Workforce Efficiency and Workforce Learning & Development through consistent, auditable execution.

10



MEXT

Metal & Mining

Industry Insights

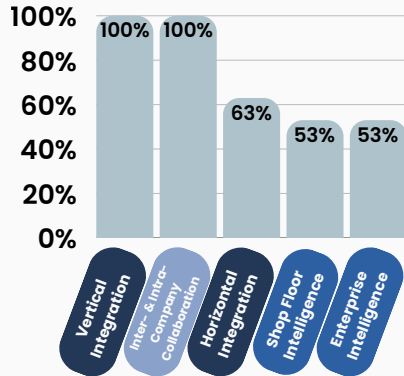
Metal & Mining Industry Dashboard



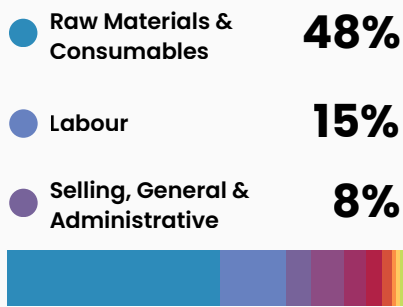
Metal & Mining

SIRI Average Score: **1.18**

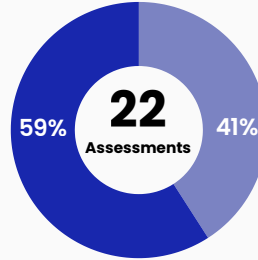
Top Prioritized Dimensions



Top Cost Profile Averages



SME - Large Analysis

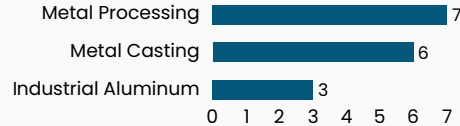


	SME	Large
Process	0.96	1.21
Technology	0.73	1.28
Organization	0.94	1.69
Overall	0.88	1.39

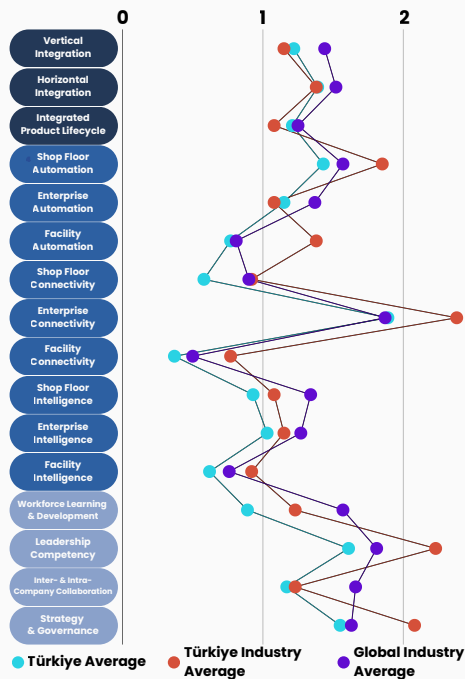
Top KPI Selecting Frequencies

	Asset & Equipment Efficiency	Planning & Scheduling Effectiveness	Workforce Efficiency
Overall	74%	68%	68%
Large	73%	73%	64%
SME	75%	63%	75%

Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	9th	9th
Technology	7th	8th
Organization	6th	7th
Overall	7th	8th

Global Source: INCIT

Initial Findings: Metal & Mining

Sub-industry Differentiation



Metal and Mining spans very different operating models, including steel, aluminum, casting, mechanical parts, mold making, and mining. Capital-intensive, continuous-process segments such as steel, foundries, and industrial aluminum prioritize quality stability, energy efficiency, and delivery performance. Yet digital maturity in these segments often remains below what the asset intensity would suggest. By contrast, metal processing and mold-making are typically SME-scale, job-shop environments. They are labor-intensive and project-driven, which elevates planning discipline, workforce efficiency, and flexible capacity management. On the mining side, long supply chains and high logistics costs become decisive, making coordination and fleet-and-material flow visibility critical performance levers.

Critical Dependencies at Low Maturity



Metal and Mining's average maturity score of 1.18 places it among the lowest across industries. This is striking given the sector's heavy capital base. Digitalization has not yet penetrated core operating processes at scale, which makes structural dependencies on energy, raw materials, and labor more fragile. The result is a clear "high investment, low digitalization" paradox. Even in capital-intensive environments – large furnaces, refining operations, and casting lines – limited data-driven control and integration constrain reliability, yield, and cost performance.

SME – Large Split: Energy and Logistics Cost Impact



Energy and logistics costs are more pronounced in large facilities. Continuous operations, high-temperature processes, and long inbound-outbound flows drive this profile. SMEs, by contrast, often operate in short-run, project-based modes, where overhead items such as SG&A and leasing-related costs become more visible. This implies two different transformation tracks. SMEs benefit most from simple automation and fast data-visibility solutions, supported by practical digital competency programs. Large companies should prioritize advanced integration and energy optimization to capture scale-level value. Advancing both tracks in parallel is key to more balanced sector development.

Raw Material and Energy Cost Pressure



In Metal and Mining, 48% of total costs come from Raw Materials & Consumables and 8% from Utilities. The energy intensity of smelting, heat treatment, and heavy processing makes energy a materially larger cost lever than in most industries. At the same time, global commodity volatility and periodic energy shocks amplify margin exposure. This pressure is pushing two priorities to the front of digitalization agendas: resource efficiency and energy optimization. Improving yield, reducing scrap, and stabilizing specific energy consumption become the fastest routes to resilience and cost competitiveness.



Asset-Intensive Industry Structure



With Asset & Equipment Efficiency KPI selection ratio at 74%, the sector clearly recognizes the leverage of capital-intensive assets such as blast furnaces, rolling mills, and mining equipment. Depreciation as a share of revenue is relatively low, reflecting long-lived, durable assets with slow replacement cycles. Yet maintenance and repair costs remain material, and they are often the first visible signal of reliability stress. The core issue is not asset wear alone, but the economics and risk of interruption. Even if assets depreciate slowly, the opportunity cost of unplanned downtime is extremely high. It also carries immediate safety exposure. For this reason, the governing rule in Metal and Mining Industry is timely maintenance and process stability. In many cases, this delivers more value than incremental gains from quality KPIs, because it protects throughput, energy efficiency, and safe execution simultaneously.

Planning and Workforce Balance



Planning & Scheduling Effectiveness and Workforce Efficiency are priorities for both large companies and SMEs. This reflects an operating model where performance depends not only on equipment, but also on disciplined shift execution and workforce coordination. The emphasis on Workforce Efficiency KPI is stronger among SMEs (selection ratio at 75%). This indicates that small-scale metal processing and foundry workshops remain labor-intensive and are progressing more slowly in automation and standardized execution.

Traceability Gap in Quality Management



In metal and mining, scrap, out-of-tolerance products, and surface defects can reach up to 5–7% of total cost. Yet Process Quality KPI is still prioritized at a relatively low level. This creates a gap between the value at stake and the KPI focus. Without lot-based genealogy, digital footprint of NDT results, and tighter integration of quality data across systems, traceability remains fragile. Over time, this makes export compliance harder and increases exposure on claims, rework, and delivery disruption.



Safety and Workforce Risk



Safety KPI is prioritized by only 16% in the sector, despite Metal and Mining being among the highest-risk operating environments. This signals a misalignment between risk exposure and digital investment focus. Safety is still managed largely through manual tracking and supervisory controls, particularly at mining sites. Without real-time monitoring of gas, vibration, and geotechnical conditions, risk remains structurally elevated. Limited deployment of IoT-enabled safety solutions, early-warning systems, and automated monitoring creates a material strategic vulnerability, with direct implications for people, uptime, and license to operate.

Carbon Footprint and Sustainability Pressure



The metal and mining sector is among Türkiye's highest-emitting industrial sectors. For exporters – especially in aluminum and steel – EU Green Deal requirements and CBAM will translate emissions performance into direct commercial pressure. Yet energy optimization still does not appear to be approached systematically across the sector. This is where digitalization becomes decisive. Digital carbon accounting, process-level emissions analytics, and energy performance visibility can become the “make-or-break” threshold for global competitiveness, not just a compliance exercise.



Metal & Mining Roadmap: Digital Breakthrough

1

Integrated Process Control and SCADA-MES Connection: Connect melting, rolling, and coating operations through SCADA-MES. Enable near real-time visibility from setpoints to output quality. Strengthen Shop Floor Intelligence and improve Process Quality through tighter control and faster deviation response.

2

Digital Workforce and Shift Planning System: Making workforce distribution transparent by digitally tracking shift schedules particularly in foundries, rolling mills, and mines; reducing overtime, shift conflicts, and safety risks. This strengthens the Workforce Efficiency KPI in labor-intensive operations and ensures production continuity.

3

Equipment Health & Predictive Maintenance: Scale condition monitoring on rolling mills, compressors, furnaces, and critical rotating equipment using vibration, temperature, and electrical current signals. Move from breakdown response to planned intervention. Improve Asset & Equipment Efficiency and strengthen Vertical Integration by linking asset health to production planning.

4

Scrap and By-Product Traceability Platform: Track scrap, slag, and by-product flows digitally from source to recovery and reuse. Improve yield recovery, reduce raw material intensity, and support sustainability KPIs. Lift Process Quality by closing the loop between defect drivers and material losses.

LIMS Integration (Quality-to-Process Loop): Integrate lab results (ore composition, purity, coating quality, chemical content) with production context through LIMS-MES-ERP linkage. Automate feedback into process decisions and shorten the investigation cycle. Strengthen Process Quality, reduce off-spec production risk, and position the lab as an active process optimization function, not only a verification step.

Digital Supply Chain Simulation Program: Simulates raw material procurement, logistics, and final product delivery on a single platform to develop alternative scenarios against global commodity price fluctuations; transforms the Time to Delivery KPI into a strategic advantage while strengthening the Horizontal Integration dimension.

Logistics and Materials Flow Visibility (Conveyors, Fleet, Cranes): Digitize end-to-end material movement between mine, furnace, and processing plants. Improve dispatch discipline, queue management, and handover visibility. Strengthen Horizontal Integration and improve Time to Delivery through fewer bottlenecks and fewer "blind spots" in internal logistics.

Energy Load Balancing and Smart Metering: Monitor high-load assets and balance consumption during peak periods. Improve specific energy consumption and reduce avoidable utility costs. Reinforce Planning & Scheduling Effectiveness by linking energy constraints to production plans and shift decisions.

IoT-Based Field Safety Monitoring: Expand real-time monitoring of gas, vibration, pressure, and geotechnical conditions at mine sites and high-risk zones. Enable early warnings and faster escalation paths. Improve Safety while protecting uptime by preventing incidents and forced stoppages.

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MEXT

Fast Moving Consumer Goods

Industry Insights

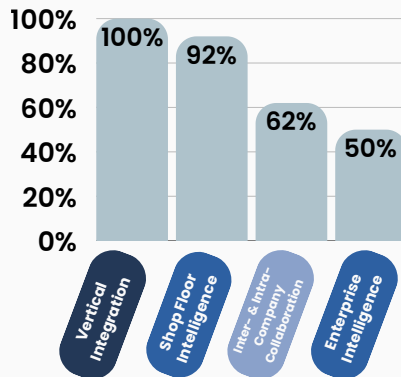
FMCG Industry Dashboard



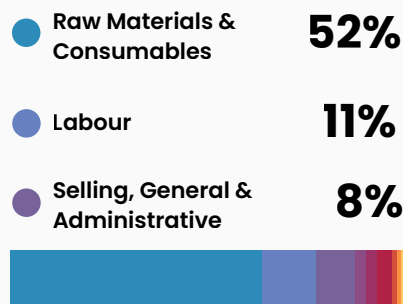
Fast Moving Consumer Goods

SIRI Average Score: **1.36**

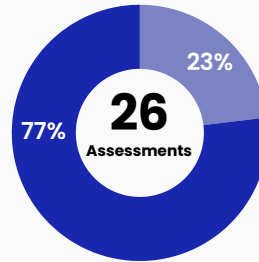
Top Prioritized Dimensions



Top Cost Profile Averages



SME - Large Analysis

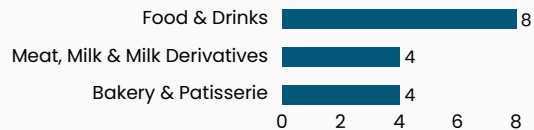


	SME	Large
Process	1.00	1.40
Technology	0.70	1.30
Organization	0.83	1.85
Overall	0.85	1.52

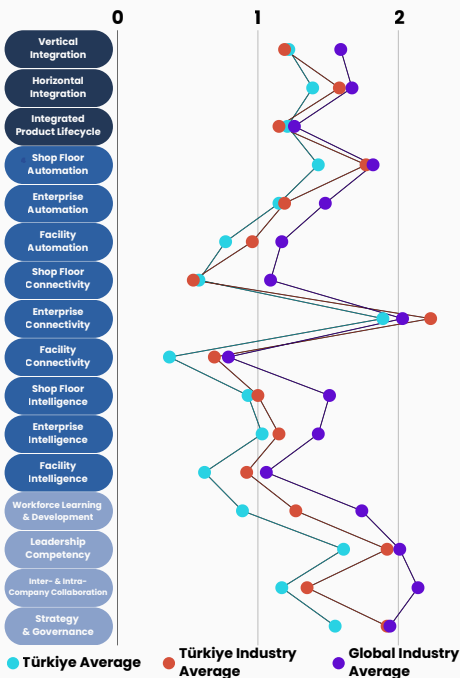
Top KPI Selecting Frequencies

	Asset & Equipment Efficiency	Workforce Efficiency	Planning & Scheduling Effectiveness
Overall	73%	65%	58%
Large	75%	70%	55%
SME	67%	50%	67%

Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	3rd	6th
Technology	6th	2nd
Organization	5th	3rd
Overall	5th	4th

Global Source: INCIT

Initial Findings: FMCG

State of FMCG Sub-Industries



Cold-chain and hygiene requirements shape digital priorities in meat and dairy. High throughput and distribution efficiency are decisive in bakery. Brand value and rapid market access drive the agenda in beverages. This diversity creates different digitalization speeds across the sector. It also creates clear opportunities for cross-learning and faster replication of proven practices across sub-industries.

Supply Chain Transparency



Food, dairy, and bakery categories are strongly tied to agricultural inputs. This increases exposure to climate volatility, price shocks, and logistics constraints. As a result, digitalization must prioritize supply chain transparency and source diversification to strengthen resilience and protect service levels.

Conflicting Perspectives on Inventory and Stock Tracking



Inventory Efficiency KPI is selected by 83% of SMEs, but only 40% among large companies. The split is logical in the short term. SMEs treat inventory control as critical due to tighter working capital and higher cash sensitivity. Large companies often feel protected by stronger sourcing, scale, and distribution capability. However, this can be a blind spot. In high-SKU environments with complex distribution networks, inventory optimization is a major margin lever. For large companies, treating inventory as “managed by scale” can leave significant savings unrealized and increase exposure to obsolescence and service-level volatility.

Capacity Utilization: The Fragility of High-Speed Lines



The Asset & Equipment Efficiency KPI selection ratio is at 73%, underscoring the need to keep high-speed lines running at high utilization. In short shelf-life categories, this operating model is inherently fragile. Even a small stoppage can trigger rapid write-offs and large financial losses. For FMCG, predictive maintenance is therefore a necessity, not an option. It protects throughput, reduces waste, and stabilizes service levels under tight freshness and delivery constraints.

Digital Management of Demand Fluctuations



FMCG demand shifts fast. Campaigns, promotions, and seasonality can change volumes and mix within days, directly impacting production and distribution plans. This is why Planning & Scheduling Effectiveness KPI is selected at high rates. The stakes are high. Planning errors translate directly into waste, lost sales, and margin erosion, especially in short shelf-life categories. Stronger demand sensing and tighter plan-to-execute control, therefore, become core value levers for the sector.



Shelf Life and Product Variety Pressure



Short shelf life and high product variety create structural complexity in FMCG. Without digital recipe management, variant planning, and faster changeover discipline, variety quickly turns into efficiency loss. Yet Production Flexibility KPI is selected by only 15%, suggesting that many companies still prioritize high-capacity standard lines and treat flexibility as secondary. This is a growing constraint. Consumer preferences are shifting faster, and promotions increase mix volatility. Planning efficiency alone cannot absorb this volatility. Without stronger production flexibility, service levels and waste outcomes remain structurally exposed.

Blind Spots in Storage & Distribution



In FMCG, competition is won as much on the shelf as on the line. Although Transportation & Distribution appears low in the cost profile (3%), distribution performance is a critical competitive driver. Large companies benefit from scale and established networks, while logistics remains a core constraint for SMEs. Under-prioritizing this area in digitalization creates a service-level disadvantage, particularly in customer delivery times. For SMEs, the highest-impact levers are digital route optimization, cold-chain visibility, and practical warehouse automation to improve accuracy, speed, and reliability.

Brand and Customer Experience Pressure



In beverages and many FMCG categories, loyalty is driven primarily by brand experience, not only price or delivery speed. This shifts value creation beyond operations. Integrating customer data, consumption patterns, and promotional response into analytics can therefore create a strategic advantage, strengthening decisions on assortment, pricing, and activation, not just operational KPIs.

High Awareness According to Utilities, But Insufficient Priority



Utilities Efficiency has the highest KPI selection ratio across industries within FMCG. Among SMEs, it reaches 67%, signaling strong awareness of cooling, steam, and energy intensity in food and beverage operations. Yet energy efficiency is often treated as a secondary priority, eclipsed by more visible cost items such as Raw Materials & Consumables (52%) and Labor (11%). This is becoming a strategic risk. Energy prices remain volatile, and carbon expectations are tightening across markets and customers. Digital solutions such as smart metering, energy management systems, and optimization analytics can therefore deliver both cost advantage and sustainability credibility, especially for plants with cold-chain and thermal-process loads.

Leadership and Strategy Weakness in SMEs



In large companies, Leadership Competency and Strategy & Governance sit close to Band 2, supported by stronger governance routines and broader market experience. In SMEs, these dimensions remain around Band 1. This gap suppresses the sector's ability to scale digital initiatives beyond isolated projects and pulls down overall maturity. The upside is significant. SMEs can narrow this gap with lightweight strategy toolkits, clearer governance rhythms, and targeted capability-building programs that translate intent into execution.





1

Digital Supplier Collaboration Platform: Connect agricultural, dairy, and meat suppliers through a shared, standards-based platform with digital certificates, quality status, and shipment milestones. Add exception workflows for non-conformities and late deliveries, supported by automated notifications. Strengthen Vertical Integration and Inter- & Intra-Company Collaboration, while reducing food safety exposure and input-cost volatility.

2

Demand Forecasting and Digital Planning Platform: Combine demand forecasting and planning logic to align production, inventory, and distribution under high volatility. Improve freshness outcomes and reduce waste driven by plan breaks. Strengthen Planning & Scheduling Effectiveness with better service levels and lower expediting.

3

Product Variety and Digital Recipe Management: Digitize recipes, parameters, and variant rules to industrialize changeovers and enable faster rollouts. Convert SKU proliferation from an efficiency penalty into a controlled operating model. Strengthen Process Quality by reducing variability during changeovers and ensuring consistent execution.

Food Safety Traceability Systems: Implement lot-level genealogy from inbound raw materials to finished goods, including digital quality gates and automated capture of key checks. Enable rapid containment with searchable trace-back/trace-forward and recall simulation routines. Strengthen Process Quality by reducing investigation time and improving compliance readiness.

Shelf Life and Waste Management

Analytics: Integrate sell-out, inventory age, and production signals to predict expiry risk and trigger actions early. Add early-warning dashboards for high-risk SKUs and sites. Strengthen Shop Floor Intelligence and lift Process Quality through tighter freshness control and faster decision cycles.

Cooling and Energy Management

Systems: Build real-time visibility for refrigeration, steam, and compressed air loads, then apply rule-based optimization for peak periods and idle losses. Add alerts for abnormal consumption patterns and equipment drift. Strengthen Utilities Efficiency while protecting margin under energy volatility and supporting carbon reporting requirements.

Customer and Brand Experience

Analytics Platform: Combine customer, channel, and promo response data into a single analytics layer. Use segmentation and basket insights to refine assortment, pack-price architecture, and activation timing. Reinforce Inter- & Intra-Company Collaboration by aligning sales, marketing, and supply chain on shared demand signals and performance outcomes.

4

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MEXT

Advanced Manufacturing

Industry Insights



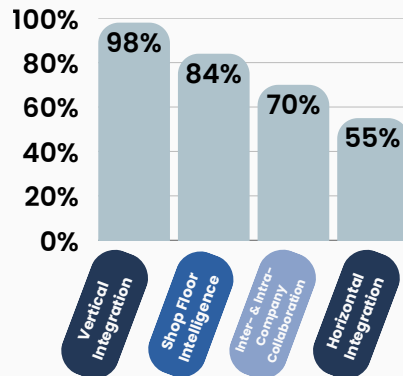
Advanced Manufacturing Industry Dashboard



Advanced Manufacturing

SIRI Average Score: **1.09**

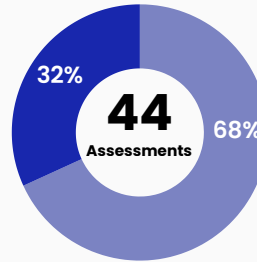
Top Prioritized Dimensions



Top Cost Profile Averages



SME - Large Analysis

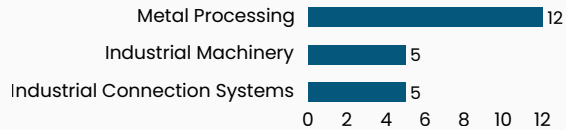


	SME	Large
Process	1.10	1.38
Technology	0.79	1.11
Organization	1.11	1.38
Overall	1.00	1.29

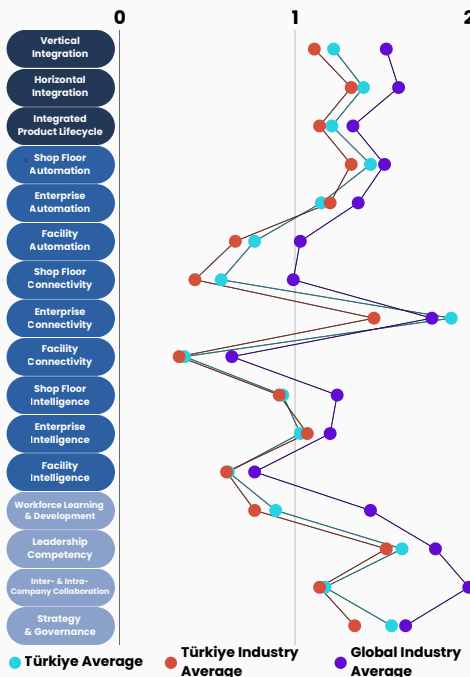
Top KPI Selecting Frequencies

	Planning & Scheduling Effectiveness	Asset & Equipment Efficiency	Workforce Efficiency
Overall	89%	66%	66%
Large	93%	57%	64%
SME	87%	70%	67%

Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	6th	7th
Technology	8th	7th
Organization	8th	5th
Overall	8th	6th

Global Source: INCIT

Initial Findings: Advanced Manufacturing

Structure of Sub-Industries



Advanced Manufacturing spans metal processing, industrial machinery, and industrial connection systems. These sub-industries share high-precision, low-tolerance production requirements and strong exposure to global supply chains. However, their value drivers diverge.

In fasteners and serial parts, cycle time, scrap, and quality consistency are decisive. In heavy machinery, program execution, delivery reliability, and technical integration with the customer are more critical. The implication is clear: the digital strategy and roadmap must be tailored by sub-industry rather than applied as a single, uniform model.

Wide Scope, Fragmented Digital Maturity



A large share of companies classified under “Advanced Manufacturing” are not high-tech by nature. Many operate in traditional segments such as fasteners, metalworking, industrial machinery, cables, or agricultural equipment. This breadth is a key reason the average maturity remains low at 1.09. Digital needs and priorities vary sharply by sub-industry, which makes it difficult to build a shared transformation momentum. While niche domains such as defense or sensor and control systems show more advanced use cases, they do not yet shift the overall profile. The aggregate picture, therefore, remains predominantly in the lower bands.

SME – Large Differentiation



SMEs represent roughly 68% of assessed companies in this segment, and this weight is reflected in the overall maturity profile. Large companies typically reach higher integration levels, supported by broader customer requirements and stronger global connectivity. SMEs, in contrast, remain constrained by basic automation and limited operational visibility. The cost structure reinforces the split. SMEs carry higher labor intensity and rely more on flexible financing tools such as leasing. Large companies are more material-driven, with raw materials at 52% of total cost, yet R&D budgets remain limited. The result is two operating models: SMEs run short-horizon, project-based, labor-intensive execution, while large companies operate with a more capital and material-intensive structure.

KPI Preferences and Business Priorities



Planning & Scheduling Effectiveness KPI is prioritized by 89% of companies, reflecting a strong need to manage demand volatility and balance capacity. Long cycle times and batch-heavy production – common in metal processing and industrial machinery – make capacity utilization a primary performance lever. Asset & Equipment Efficiency KPI with a high selection ratio (66%) reinforces the same point. High-cost machines must run reliably and at high utilization to protect margins. The equally high selection of Workforce Efficiency (66%) highlights the continuing role of labor productivity, particularly in SME-heavy structures. The message is clear: value creation requires parallel progress in equipment performance and workforce execution, not one or the other. In contrast, Production Flexibility (16%) and Time to Market (7%) remain low. This indicates a sector still optimized for utilization over agility.



Material Efficiency: Silent Waste



Raw material exposure is high, yet Raw Material & Consumables and Inventory Efficiency are not a top KPI focus. In practice, tolerance-driven scrap, tool wear, rework, and frequent setup changes create “micro-losses” that stay invisible in day-to-day operations. Stronger NC program governance, digital work instructions, and tool-life analytics make this silent waste measurable. Once visible, it can be systematically reduced through more stable setups, fewer revisions, and tighter process control.

Planning – Integration Paradox



Planning discipline is relatively strong, yet shop floor–enterprise (IT/OT) connectivity remains weak. As a result, schedules age quickly because they are not refreshed with real-time shop floor signals. The plan looks stable “on paper,” while execution reality diverges on the line. When scheduling engines are continuously fed with OEE, downtime, and scrap signals, plans become executable and resilient. This alignment reduces this gap and makes planning outcomes consistently visible on the shop floor.

Timing of Quality Data



Product Quality is selected by 59% of the companies in the sector, confirming that quality is a major priority. Yet quality checks are often performed at the end of the lot. This timing detects issues, but it does not prevent them, so scrap and rework remain structurally high. Station-based SPC, inline measurement, and real-time quality analytics shift quality upstream. They flag drift earlier, enable faster correction, and turn quality from a reporting activity into a proactive control mechanism.

Project-Based Production and Delivery Risk



In heavy machinery and specialized equipment manufacturing, project management and execution is at the core of digitalization. Yet delivery dates and project costs often remain unpredictable because shop floor data is incomplete or late. Digital project management tools, paired with real-time field integration, reduce this uncertainty. They improve milestone control, surface risks earlier, and stabilize delivery performance without sacrificing engineering flexibility.

Low Shop Floor Connectivity



Many machines still run as standalone assets. Data capture is limited, and shop floor links to enterprise systems remain weak. This constrains core use cases such as reliable OEE visibility and predictive maintenance. Stronger IT/OT integration is, therefore, foundational. It enables planning signals and shop floor reality to run in the same operating cycle, reducing plan breaks and turning execution data into actionable decisions.

Insufficient Strategy & Governance



Strategy & Governance is relatively stronger in some large companies, but the shortfall is clear among SMEs. When the maturity remains around Band 1, digital initiatives tend to be isolated, owner-dependent, and hard to scale. Projects can still deliver quick improvements. Yet without a coherent roadmap and governance rhythm, these gains do not compound, and digitalization does not translate into sustained competitive strength.





Advanced Manufacturing Roadmap: Digital Breakthrough

1

Digital Scheduling and Capacity

Balancing System: Integrate ERP and MES to align orders with machines and labor capacity. Identify bottlenecks early and reduce last-minute replanning. Strengthen Vertical Integration, improve Planning & Scheduling Effectiveness, and limit avoidable material loss through better plan adherence.

2

Connectivity Solutions: Standardize data flow from machines to MIS/MES using IoT gateways and OPC-UA connectivity, especially for SME-scale manufacturers. Reduce manual data entry and make execution data usable at scale. Strengthen Shop Floor Intelligence and Asset & Equipment Efficiency.

3

Digital Quality Control and Inline

Measurement: Shift from end-of-lot checks to station-based SPC and inline measurement. Detect drift early and prevent scrap before it accumulates. Strengthen Vertical Integration, improve Product Quality, and reduce raw material losses.

4

Machine and Tool Monitoring Systems:

Monitor tool wear, micro-stops, and condition signals across CNC, press, and machining lines. Convert hidden losses into actionable constraints for planning and maintenance. Strengthen Shop Floor Intelligence, improve Asset & Equipment Efficiency, and reduce maintenance-related cost leakage.

5

Supply Chain Visibility and Risk

Analytics: Build traceability and supplier risk sensing for imported metals and critical components. Improve resilience via alternative sourcing scenarios and clearer inventory decisions. Strengthen Horizontal Integration and Inter- & Intra-Company Collaboration, improve Inventory Efficiency, and optimize transportation and distribution outcomes.

Logistics & Warehouse Synchronization

Solutions: Synchronize inventory, shipment status, and routing data across OEMs and parts manufacturers. Reduce expediting and improve delivery reliability through shared visibility. Strengthen Horizontal Integration, improve Inventory Efficiency, and optimize transportation and distribution costs.

6

Project Management and Version Tracking System:

Track engineering changes and configuration versions through a PLM-based shared platform across OEMs and suppliers. Reduce revision-driven defects and late-stage rework. Strengthen Inter- & Intra-Company Collaboration, improve Product Quality, and reduce R&D leakage from rework and misalignment.

7

Digital Transformation Strategy and Governance Platform:

Consolidate KPIs, cost drivers, and investment priorities into a single portfolio view with clear ownership and review cadence. Turn digitalization from projects into a managed operating agenda.

8

Operator Performance Management System:

Digitally monitor operator-based productivity, downtime reasons, and contribution to output. Use analytics to target training and standardize best practices without creating overhead. Improve Workforce Efficiency and reinforce a data-driven culture in human-machine execution.

9



MEXT

General Manufacturing

Industry Insights

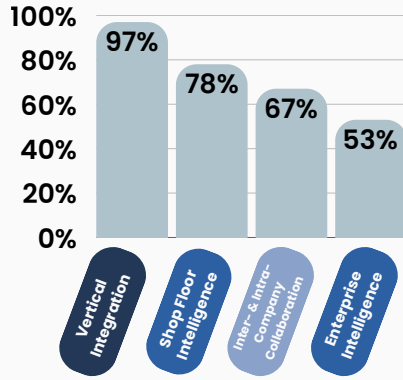
General Manufacturing Industry Dashboard



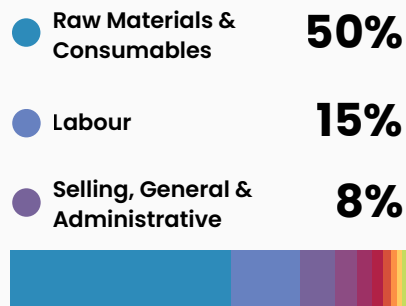
General Manufacturing

SIRI Average Score: **1.03**

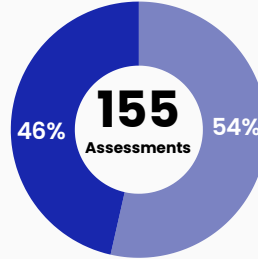
Top Prioritized Dimensions



Top Cost Profile Averages



SME - Large Analysis

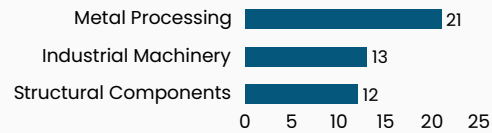


	SME	Large
Process	1.02	1.27
Technology	0.59	1.09
Organization	0.80	1.50
Overall	0.80	1.29

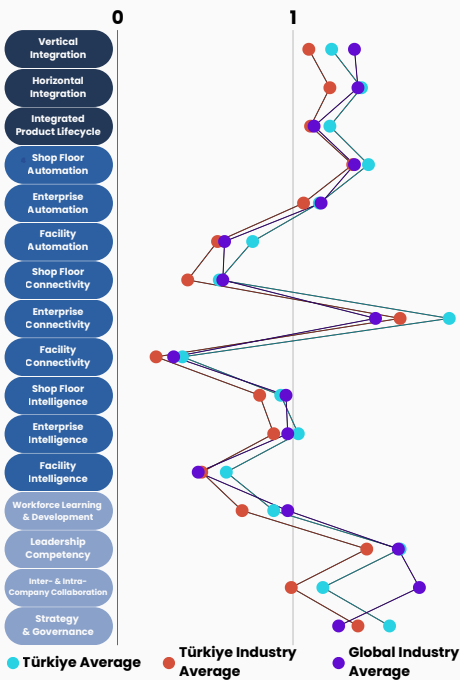
Top KPI Selecting Frequencies

	Planning & Scheduling Effectiveness	Workforce Efficiency	Asset & Equipment Efficiency
Overall	72%	72%	66%
Large	67%	69%	76%
SME	74%	77%	57%

Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	8th	10th
Technology	9th	10th
Organization	9th	10th
Overall	9th	10th

Global Source: INCIT

Initial Findings: General Manufacturing

The Heterogeneous Structure of Industries



General Manufacturing is largely based on basic and volume-oriented production, although it includes niche areas such as high-value-added defense/aerospace and advanced ceramics. Sub-industries such as metal processing, cement, agricultural machinery, plastic products, cables, and packaging materials generally operate with medium-to-low technology intensity. Companies in this industry mostly rely on labor-intensive processes and largely serve the domestic market. Niche segments such as advanced ceramics, energy equipment, and rubber and tires can reach higher scores, while the broad base—metalworking, machinery, agricultural equip., and furniture—remains low in digital maturity. As a result, the industry average stays at 1.03.

Focus Areas in KPI Preferences



Planning & Scheduling Effectiveness is selected by 72%, reflecting the sector's core priority: balancing capacity and absorbing order volatility. The near-parity in Workforce Efficiency (72%) and Asset & Equipment Efficiency (66%) signals a clear need for parallel progress in workforce execution and machine performance, not a one-sided push.

Labor Costs: Labor-Intensive Production Dynamics



Labor accounts for 12% of costs in large companies and 18% in SMEs. This gap reflects the reliance of smaller producers on labor-intensive operations. In agricultural machinery, furniture, and cable manufacturing, manual assembly, welding, machining, and finishing keep workforce dependency high. The strong selection of planning and workforce efficiency KPIs is consistent with this profile. For SMEs, the highest-impact digital levers are practical execution tools: digital shift and attendance control, standardized work instruction systems, and operator capability platforms that improve productivity and consistency.

Weakness in Flexibility and Innovation Capacity



Production Flexibility (12%) and Time to Market (13%) remain very low. This indicates limited capability for rapid product change and fast market launch. The operating model is still centered on “filling” existing capacity. In practice, machines and people are pushed to high utilization, but flexibility is weak when demand or mix shifts. This becomes a direct constraint for make-to-order companies in metalworking, machinery, and furniture. It also undermines delivery reliability when plans change late or engineering revisions occur.

Cost Profile



Raw Materials & Consumables is the largest cost item at 50%. Yet Materials Efficiency is selected by only 28% of assessed companies. This gap suggests that material losses are not sufficiently visible, even though they sit at the heart of profitability. In many companies, losses from tool wear, out-of-tolerance output, and setup-driven scrap remain “silent.” The result is a structural disadvantage, especially in metalworking and furniture, where yield, rework, and offcut management directly shape unit cost and delivery reliability.



Utilities: Blind Spot in Energy Intensive Processes



Utilities represent 5% of the total cost profile, yet Utilities Efficiency is selected by only 20%. This understates the real economics in energy-intensive sub-industries. In cement, glass, and ceramics, kilns, clinker lines, and high-temperature ovens make energy as decisive as raw materials. For these companies, digital energy management is no longer just cost optimization. It is a resilience and continuity lever that protects margins, stabilizes operations, and supports tightening carbon expectations.

Integrated Production Traceability



In General Manufacturing, product and lot-based tracking is often limited. Many processes are still managed through manual forms or basic barcode use, especially in volume-oriented areas such as food packaging, cement, and plastics. This delays root-cause analysis for quality variation and customer complaints. Stronger digital traceability makes the full flow visible, from material intake to finished goods output. It shortens containment cycles, reduces warranty and return costs, and supports regulatory and customer compliance in export markets.

Poor Connectivity and Visibility



Shop Floor Connectivity (0.40) and Facility Connectivity (0.22) are the lowest-scoring SIRI dimensions in the sector. This indicates that production data is still largely captured manually, with limited real-time flow from the field. The result is a planning paradox. Although Planning & Scheduling Effectiveness is selected by 72% of companies, weak shop Floor connectivity prevents plans from staying aligned with execution. Schedules quickly become outdated and drift toward “unrealistic” targets on the line.

Quality Perspective

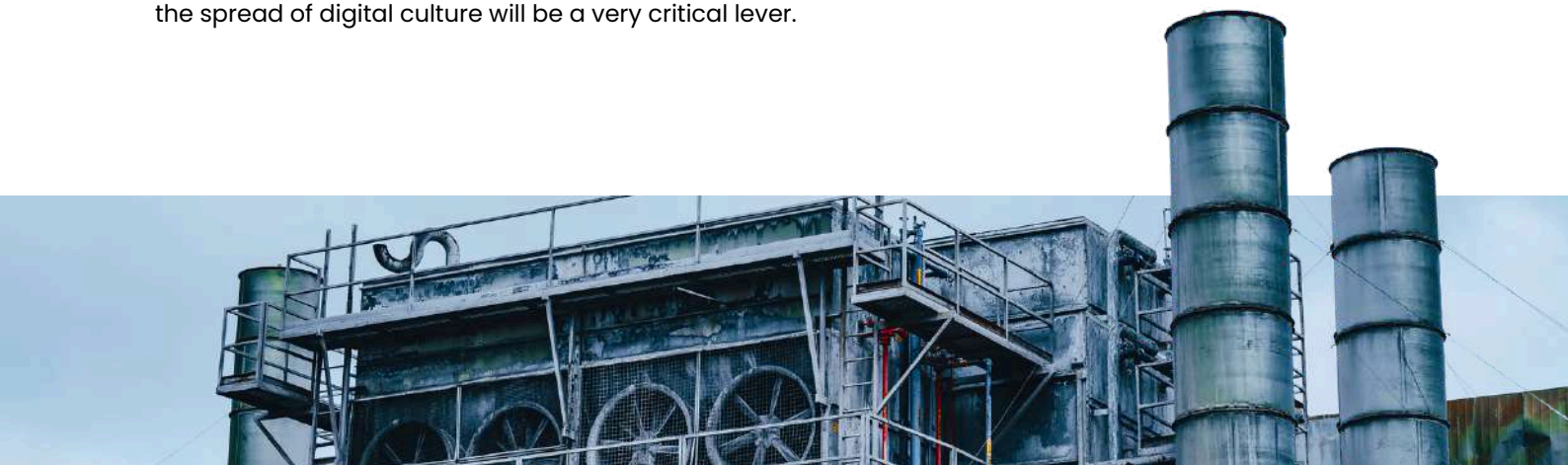


Product Quality KPI is selected by 58% in General Manufacturing, yet quality control still relies heavily on end-of-lot checks. Defects are detected after production is complete, which locks in scrap and waste costs. The impact is highest in processes where faulty output cannot be easily recovered, such as metalworking, cement production, and plastics processing. For defense, automotive, and energy equipment supply chains, late detection also threatens delivery integrity and customer confidence.

Low Human Resource Development



Workforce Learning & Development score is 0.71, one of the lowest in almost all industries. Even if technology investments are made, the workforce has not yet reached the capacity to use these systems effectively, creating the risk that digital investments will remain “irreversible” in the field. Even if technology is acquired, human resources cannot reach the capacity to use it. The training of human resources and the spread of digital culture will be a very critical lever.





General Manufacturing Roadmap: Digital Breakthrough

1

Manufacturing Execution System (MES):

Capture near real-time data across machines and stations in metal processing, cement, glass, and furniture. Make OEE, downtime, and scrap visible at the line and plant level. Strengthen Shop Floor Intelligence, Shop Floor Connectivity, and Vertical Integration, improve Asset & Equipment Efficiency, and reduce Maintenance & Repair losses.

2

Manufacturing Analytics Platform:

Quantify losses from out-of-tolerance output, tool wear, and setup-driven scrap. Convert “hidden yield loss” into a managed performance agenda. Strengthen Shop Floor Intelligence and Vertical Integration, improve Materials Efficiency, and reduce Raw Materials & Consumables leakage.

3

Recipe Management System:

Standardize recipes and variants, and control changeovers with clearer parameter discipline. Improve responsiveness without sacrificing consistency. Support Vertical Integration, strengthen Production Flexibility, and reduce Inventory pressure through tighter SKU execution.

4

Real-Time Scheduling and Capacity Management System:

Align order priority with machine and workforce capacity in one operating view. Close the plan-versus-actual gap with faster replanning based on execution signals. Support Vertical Integration and Enterprise Intelligence, improve Planning & Scheduling Effectiveness, and reduce labor inefficiency.

Project and Delivery Management Platform:

Manage engineering changes and long-cycle build milestones for machinery and equipment through a PLM-enabled project layer. Reduce revision-driven delays and coordination losses. Strengthen Inter- & Intra-Company Collaboration, improve Time to Delivery, and reduce SG&A leakage from rework and expediting.

Digital Quality & Traceability Cloud:

Shift quality from end-of-lot checks to station-based, near real-time control with lot genealogy. Accelerate containment and audit readiness. Strengthen Vertical Integration, improve Product Quality, and reduce raw material waste tied to late defect detection.

Operator Support and Training Platform (Digital Work Instruction & AR):

Deploy digital work instructions and AR-enabled support for maintenance and quality tasks. Reduce variability across shifts and sites. Strengthen Workforce Learning & Development, improve Workforce Efficiency, and limit labor-related losses.

Energy Monitoring & Efficiency Platforms:

Track energy consumption in real time in cement, glass, and ceramics, and translate consumption into actionable operating signals. Support Shop Floor Intelligence, strengthen Utilities Efficiency, and reduce utilities cost exposure.

Digital Security and Traceability Platform:

Implement baseline cybersecurity and traceability requirements for companies producing parts for critical sectors. Improve trust, compliance readiness, and data integrity across interfaces. Strengthen Connectivity, Integration, and Inter- & Intra-Company Collaboration, and reduce disruption and quality-risk costs.

5

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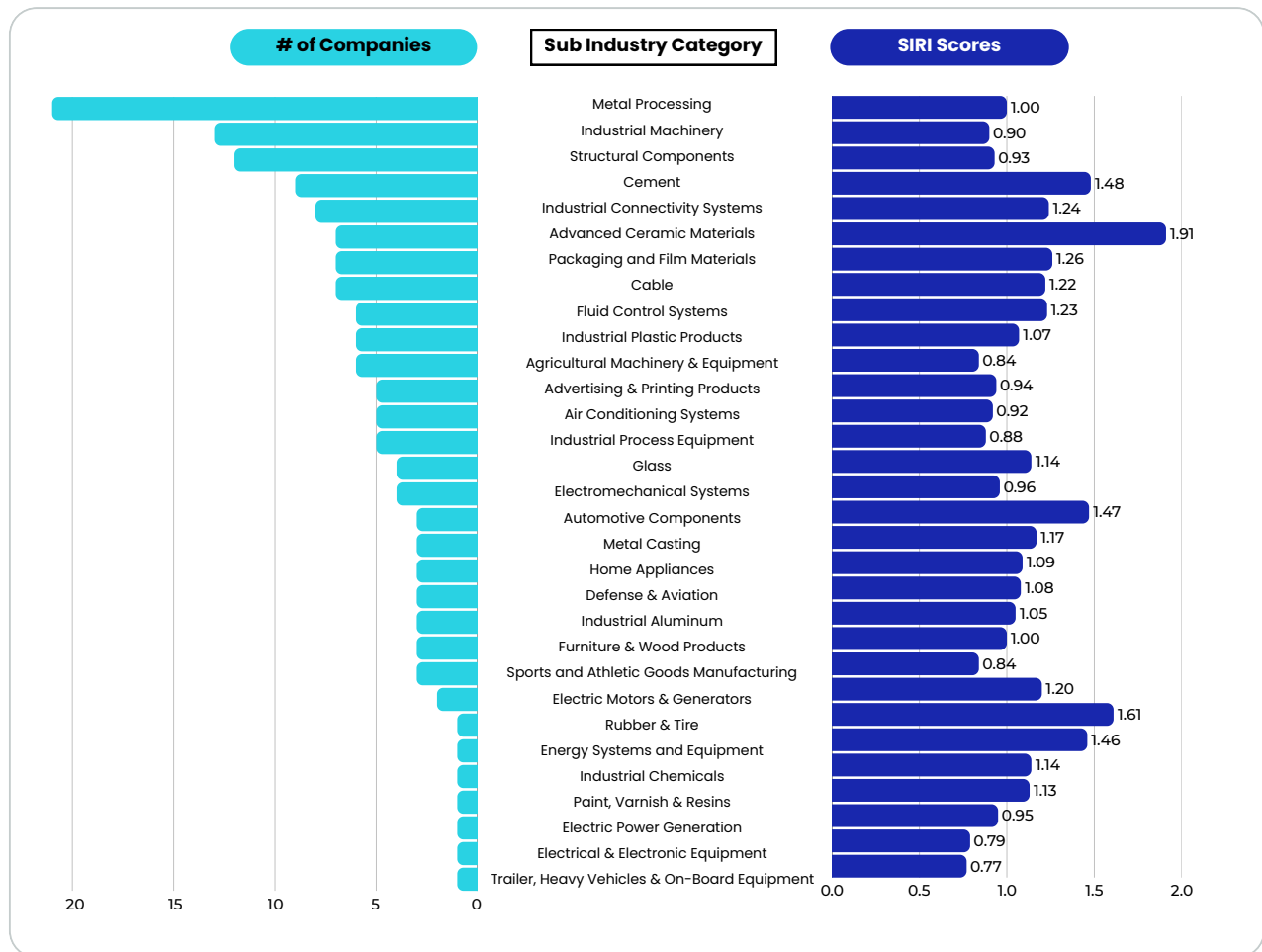
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In-depth Analysis of General Manufacturing Sub-Industries

Figure 35 | General Manufacturing Sub-Industry Categories



High Scores in Capital-Intensive Industries

Digital maturity is notably higher in advanced ceramics, rubber and plastics, cement, automotive components, and energy equipment. These segments operate under tighter process tolerances, and more capital-intensive economics. In ceramics, small process deviations can translate into outsized losses. In energy equipment and automotive components, certification and traceability are entry tickets to global supply chains. As a result, companies in these segments treat digitalization less as a cost advantage and more as a requirement to operate and compete. They act as the sector's digital "locomotives." However, their representation is limited, so their ability to lift the overall industry average remains constrained.

Low Maturity in the Main Mass

The largest sub-industries, such as Metal Processing (1.00), Industrial Machinery (0.90), Structural Components (0.93), Agricultural Machinery (0.84), and Furniture & Wood (1.00), remain at low maturity. This is the main reason the overall industry average stays at 1.03. These segments carry the volume, but they also carry the digital gap. Many companies operate in make-to-order modes and absorb delivery pressure through longer shifts and higher labor intensity. Digitalization is not yet embedded in the operating model, so capacity increases are still achieved through people rather than automation, connectivity, or analytics. In effect, the sector's critical mass is still concentrated in the lower maturity bands.



Digital Transformation Roadmap for General Manufacturing Sub-Industries



Metal Processing and Mechanical Parts

Manufacturing: Deploy tool-life analytics for CNCs, integrate automated measurement, and tighten tolerance governance. Reduce scrap and rework, improve Materials Efficiency, and stabilize repeatability across shifts.



Industrial Machinery and Automation:

Implement digital project controls, delivery milestone tracking, and real-time progress reporting for long-cycle builds. Reduce schedule slippage, improve Time to Delivery, and strengthen customer confidence through clearer execution visibility.



Structural Components:

Combine project-delivery management with real-time quality capture at sourcing and assembly points. Reduce delivery delays, improve Planning & Scheduling Effectiveness, and cut late-stage rework.



Cement: Roll out digital energy management and process optimization for kilns and grinding lines. Reduce CO₂ intensity and energy cost exposure, and improve operational stability in continuous processes.



Connectors and Accessory Systems:

Introduce scrap monitoring, serial and batch traceability, and automated quality reporting in high-volume lines. Reduce production losses, strengthen Product Quality, and shorten containment cycles for customer issues.



Packaging and Film Materials:

Establish batch genealogy, digital quality control, and controlled recipe and variant management. Reduce waste, improve consistency, and strengthen audit readiness for demanding customers.

Cable: Quality control with inline sensors on drawing and coating lines; reel/batch traceability; reduces scrap rates and supply chain risks.



Fluid Control Systems: Digital project management and test station integration in assembly-focused production; increases delivery reliability and reduces post-service costs.



Industrial Plastic Products: Mold efficiency and cycle time analytics, raw material recipe management; reduces material losses, optimizes raw material costs.



Agricultural Machinery & Equipment:

Digital project-delivery management for long-cycle orders, supplier-customer integration; improves on-time delivery performance, increases major customer confidence.



Advertising & Printing Products: Digital job instructions and color-quality sensor integration during frequent setup changes; reduces scrap and waste, enhances product quality, and lowers raw material and consumable costs.



Defense: Institutionalize regulation-driven digital documentation, end-to-end serial and batch traceability, and integrated certification workflows. Strengthen compliance and supply reliability, with cybersecurity controls as a baseline to protect data integrity and confidentiality. Scale selective shop floor automation, such as smart fixtures, digital torque capture, and sensor-based quality checks, to increase precision and reinforce domestic capability depth.





MEXT

Pharmaceuticals & Healthcare

Industrial Insights

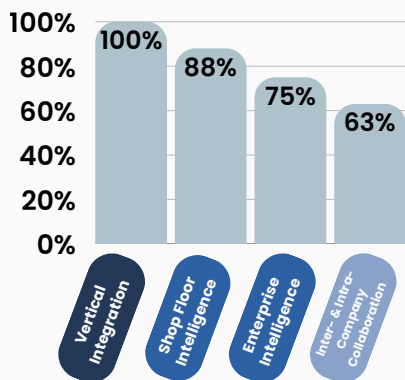
Pharmaceuticals & Healthcare Industry Dashboard



Pharmaceuticals & Healthcare

SIRI Average Score: **0.99**

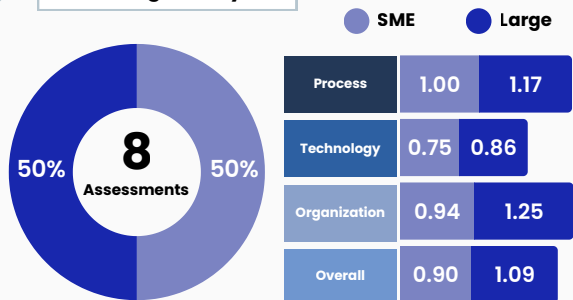
Top Prioritized Dimensions



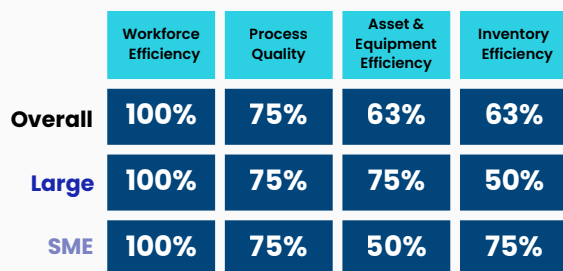
Top Cost Profile Averages



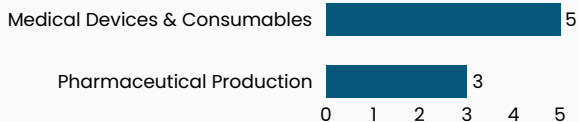
SME - Large Analysis



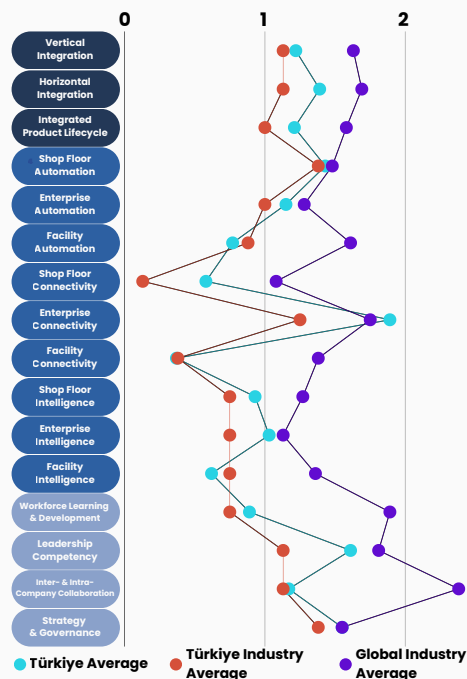
Top KPI Selecting Frequencies



Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	10th	3rd
Technology	10th	3rd
Organization	10th	4th
Overall	10th	3rd

Global Source: INCIT

Initial Findings: Pharmaceuticals & Healthcare

Sub-Industry Structure



Two profiles dominate the Pharmaceuticals and Healthcare Industry in Türkiye: medical devices & consumables and pharmaceutical manufacturing.

Medical Devices and Consumables: Product variety is higher, and production is more fragmented and assembly-heavy. Speed and responsiveness matter more than in pharma production, so Production Flexibility KPI is selected more often. However, these companies are typically SMEs, and baseline capabilities such as Shop Floor Connectivity are often weak. To access global markets, they must meet traceability, sterilization control, and cybersecurity certification requirements. Many SMEs participate in this space, but limited digital foundations keep them in a constrained role within global supply chains.

Pharmaceutical Manufacturing: Production is campaign-based, batch-driven, and generally more automated, but flexibility is not a primary focus. The flow is built around batch discipline, starting with API and excipient preparation and moving through validation and stability controls. Documentation requirements are heavy at every step. Process Quality and Workforce Efficiency stand out because deviations can trigger costly scrap, recalls, and reputational risk. Inline monitoring and electronic batch records are core levers to reduce deviation rates and strengthen batch release confidence.

Low Digital Maturity, High Expectations



With an average digital maturity score of 0.99, Pharmaceuticals and Healthcare ranks among the lowest across assessed industries. This is a clear mismatch with sector expectations, where regulation, quality discipline, and documentation rigor are non-negotiable. In pharmaceutical production, GMP requirements, validation, and documentation sit at the core of daily operations. Yet many of these practices still rely on manual routines or partial digital tools. This creates gaps in data integrity, traceability, and execution efficiency, even where compliance intent is strong.

Raw Material Cost: Low Share, High Dependency



In Pharma and Healthcare, Raw Materials & Consumables cost account for 34%, well below many other industries. This does not mean input dependency is low. On the pharma side, APIs and excipients are high-value and supply-sensitive, even if they are not the largest cost burden. On the medical device side, reliance on imported components is a structural constraint. Overall, cost pressure is shaped less by line economics and more by compliance intensity. Regulatory readiness, documentation rigor, and release discipline drive a significant share of effort and overhead across the sector.

Labor Intensity



Labor accounts for 17% of costs, placing it among the higher shares in the sector. This is largely driven by regulation-related workload, such as documentation, quality testing, validation routines, and certification activities, which remain people-intensive in many companies. The fact that Workforce Efficiency is selected at 100% confirms where companies feel the pressure most.

SG&A: The Cost of Compliance and Licensing Processes



SG&A is high at 12%, reflecting the sector's compliance-heavy operating model. Licensing activities, clinical obligations, pharmacovigilance, and regulated marketing requirements add significant overhead. Unlike many industries where production dominates the cost base, administrative and regulatory workstreams carry more weight here. Digitalization in these functions is often underemphasized, despite clear leverage. Targeted enablement, such as QMS workflow automation and structured licensing and dossier management, can reduce manual effort, shorten cycle times, and directly relieve SG&A pressure.

Utilities: GMP-Driven Energy Load



Utilities costs account for 10%, reflecting the energy load imposed by GMP conditions. Clean rooms, 24/7 HVAC, HEPA filtration, WFI systems, and sterilization cycles drive sustained consumption. Despite this, Utilities Efficiency is selected at 0%. This indicates that energy performance is not yet treated as a strategic KPI. The low Facility Connectivity score (0.38) reinforces the point: consumption data is not sufficiently visible or actionable. Room-level HVAC control, sterilization cycle optimization, and end-to-end energy monitoring are among the highest-leverage moves in this cost category.

The Challenge of Manual Processes



A large share of production, quality control, and validation work is still executed manually. Paper batch records, manual approvals, and long reporting cycles increase effort and slow execution. This helps explain why Workforce Efficiency KPI (100%) is the sector's top priority. Digitizing the compliance backbone through Electronic Batch Records (EBR) and QMS workflow automation can relieve this bottleneck directly. However, the low Workforce Learning & Development (0.75) score signals an adoption risk. Without structured capability building, digital tools will not translate into consistent execution.

Process-Focused Quality Culture



In pharma and medical device production, regulation demands that process quality is secured before product quality. The operating logic is prevention-first, not correction-after. This is reflected in the high selection of Process Quality KPI (75%). As a result, investments that shift quality control upstream should be prioritized. Inline monitoring, machine-vision inspection, and real-time quality controls help prevent deviations, reduce investigation cycles, and strengthen release confidence.

The Impact of Regulation on Inventory Management



Quarantine-release cycles, cold-chain requirements, and shelf-life constraints add complexity to inventory control. This elevates Inventory Efficiency (63%) as a priority KPI, because stock decisions directly affect availability, compliance, and waste. Stronger FEFO (first-expiry-first-out) execution is a practical lever. Integrating LIMS, QMS, and ERP data can improve expiry accuracy, reduce write-offs, and strengthen release discipline across the network.

Use of High-Value Equipment



Continuous uptime of high-value assets such as reactors, sterilizers, and filling lines is critical for both output and compliance stability. This is reflected in Asset & Equipment Efficiency selection ratio (63%) as a key KPI, and it elevates maintenance maturity as a core performance lever. With Utilities also at 10% of the total cost profile, equipment performance links directly to energy and maintenance economics, not only production continuity. Expanding predictive maintenance and condition-based routines can therefore improve profitability at the facility level, while reducing disruption risk.



Pharmaceuticals & Healthcare Roadmap: Digital Breakthrough

1

Electronic Batch Record (EBR) and Documentation Digitization: Implement EBR to replace paper records, manual approvals, and slow reporting cycles. Standardize validation and CAPA on one backbone. Improve Workforce Efficiency, reduce audit friction, and strengthen Process Quality through stronger data integrity.

2

IoT-Based Shop Floor and Facility Connectivity: Connect critical GMP utilities and environments (HVAC, WFI, steam, differential pressure, particle counts) to real-time monitoring. Trigger deviation-to-action workflows with automated alerts and CAPA initiation. Improve Facility Connectivity and intelligence, and reduce variability risk in controlled areas.

3

Predictive Maintenance and Calibration Management: Deploy condition-based maintenance for sterilization, filling, and critical utilities equipment. Digitize calibration planning and evidence trails. Improve Asset & Equipment Efficiency, reduce disruption risk, and protect batch continuity.

4

Integrated Inventory and Release Management: Synchronize quarantine-test-release flows by linking LIMS, QMS, and ERP in one closed loop. Operationalize FEFO as the default logic for expiry-driven control. Improve Inventory Efficiency, reduce trapped inventory, and accelerate cash conversion.

Inline Quality Control and Image Processing: Shift from end-of-lot checks to real-time controls using inline sensors and vision-based inspection. Reduce deviation cycles, lower scrap, and reinforce prevention-first execution, strengthening Process Quality.

5

Workforce Development Platforms: Build role-based learning paths for GMP, validation discipline, data integrity, and digital system use. Use e-learning and AR-enabled simulations to support Shop Floor adoption. Improve Workforce Learning & Development and sustain digital gains.

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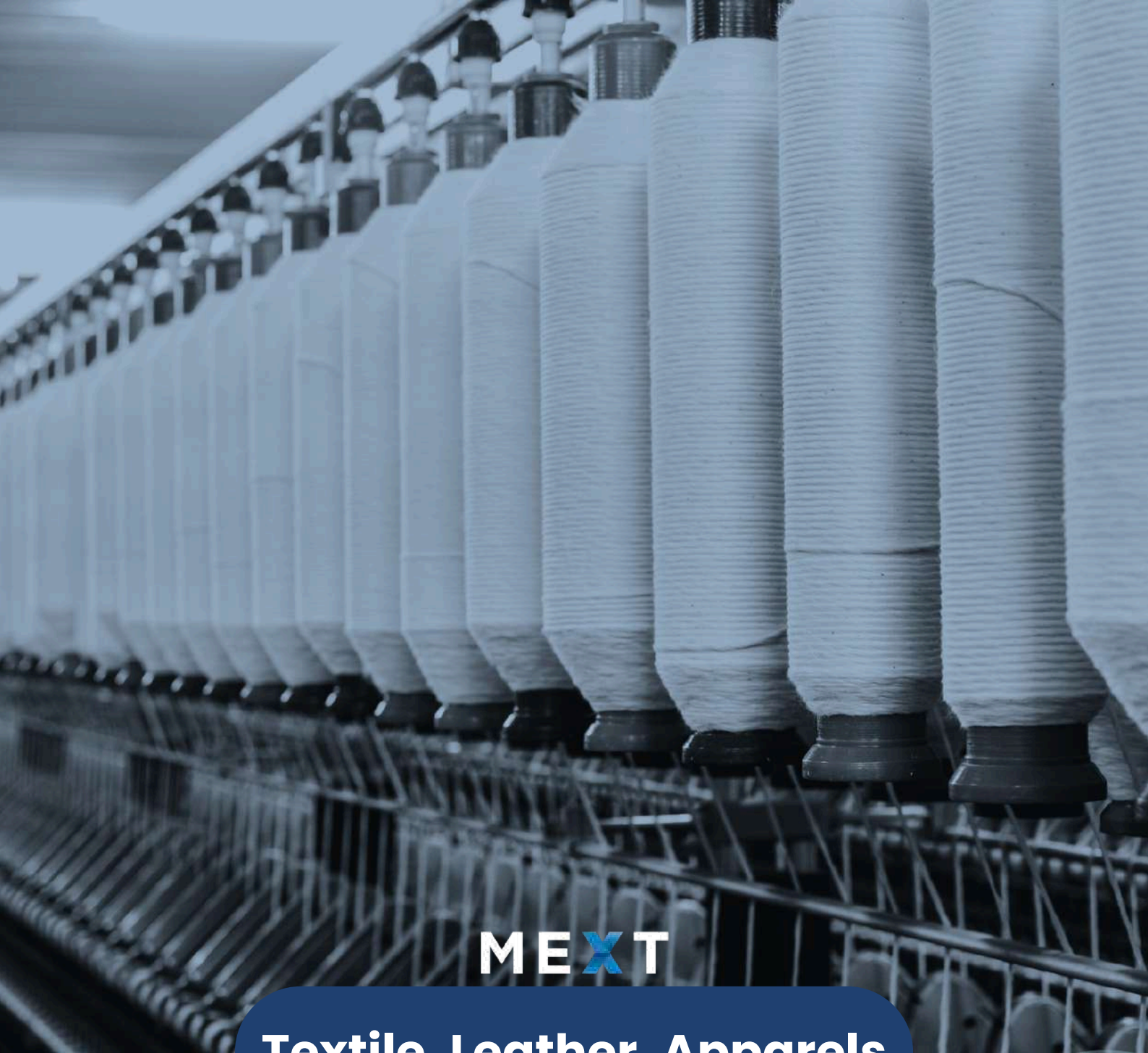
Energy Efficiency Management: Introduce dynamic control for clean rooms, HVAC, and sterilization energy loads. Make energy performance measurable and actionable to improve cost and sustainability outcomes.

7

Supply Chain Traceability and Collaboration Platforms: Enable end-to-end traceability for APIs, excipients, and critical device components across suppliers and distributors. Reduce non-compliance risk, improve responsiveness to quality events, and strengthen reliability for regulated and export markets.

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MEXT

Textile, Leather, Apparels

Industrial Insights

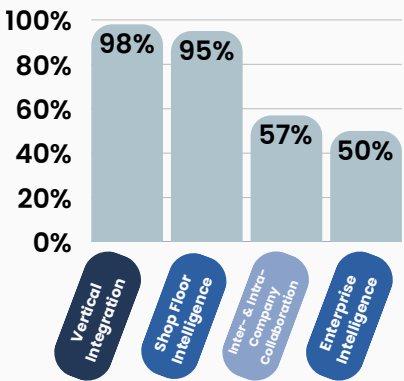
Textile, Leather, Apparels Industry Dashboard



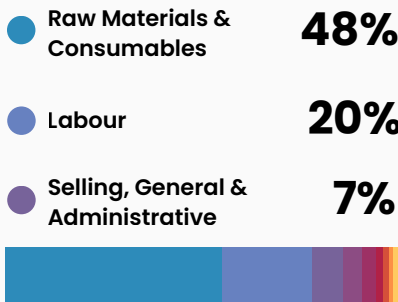
Textile, Leather, Apparels

SIRI Average Score: **0.96**

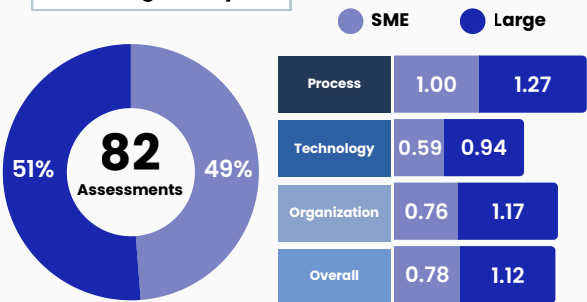
Top Prioritized Dimensions



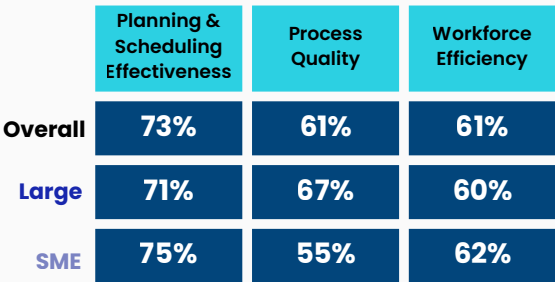
Top Cost Profile Averages



SME - Large Analysis



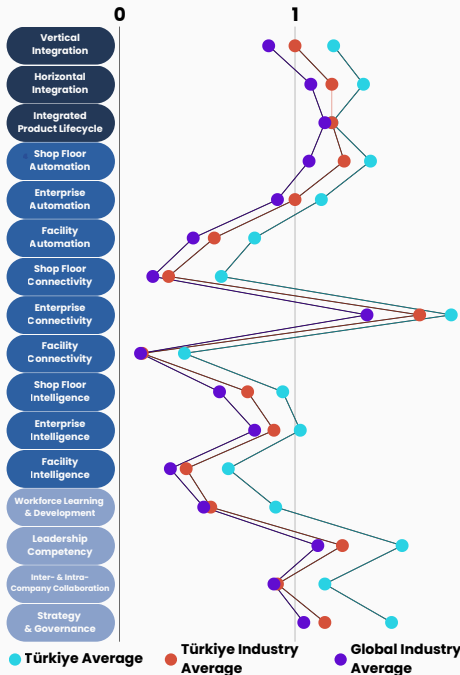
Top KPI Selecting Frequencies



Most Common Sub-Industries



Dimension Analysis & Building Block Industrial Ranking



	Rank in Turkish Industries	Rank in Global Industries
Process	7th	11th
Technology	11th	11th
Organization	11th	11th
Overall	11th	11th

Global Source: INCIT

Initial Findings

Industry Structure



Türkiye's textile sector is highly fragmented, and each sub-segment follows a different digitalization logic. Ready-to-Wear (0.87) and Socks & Accessories (0.80) sub-industry segments show the lowest maturity. These segments run on high product variety, short season cycles, and tight lead times. The operational baseline is agile planning, line balancing, and labor efficiency under volatile demand. Limited margins and frequent style, size, and color transitions increase the need for faster changeovers and higher flexibility. The operating model shifts in Fabric & Dyeing (1.00) and Home Textiles (0.96). Here, value is driven by process repeatability and quality stability, especially color and tone consistency, shrinkage control, and recipe discipline. Resource efficiency is also central because water, steam, chemicals, and energy loads shape both cost and compliance pressure. More mature segments such as Yarn & Fiber (1.29) and Denim & Leather Footwear (1.15) reflect a more capital-intensive, export-oriented profile. The priority is to protect asset performance and throughput while managing raw material batches and batch and lot traceability with high reliability.

Pressure of Demand: Planning and Scheduling



Planning & Scheduling Effectiveness KPI (73%) is the sector's top priority. Fast fashion, short lead times, and high order diversity make planning the primary determinant of delivery performance. Many manufacturers are now operating under accelerated collection cycles shaped by global brands. However, weak alignment between supply readiness and production reality keeps planning reactive. This is most visible in order-driven operations and SME environments, where planning still relies heavily on Excel and manual inputs due to limited system integration.

Raw Material Weight: 48% Pressure



Raw Materials and Consumables account for 48% of the cost base. Fabrics, yarns, leather, and dye chemicals also carry high import exposure, so global price volatility transmits quickly into unit costs. This is why Materials Efficiency (37%) matters, but limited traceability and weak integration still constrain control over consumption, yield, and loss drivers. The pressure is sharper for smaller companies. They often hold higher buffers to secure supply, which elevates the relevance of Inventory Efficiency (49%) and ties up working capital. Strengthening lot-level visibility and end-to-end supply chain alignment is the most direct route to reducing cost volatility and improving inventory discipline.

Energy Traps: Utilities 4%



Utilities costs average at 4%, but this headline figure masks sharp sub-segment differences. Energy, water, and steam loads are structurally high in dyeing and finishing, and structurally lower in garment assembly. This creates an uneven cost and sustainability profile across the sector. Despite this, the Utilities Efficiency KPI is selected at only 22%, signaling that energy performance is not yet treated as a core lever. The very low Facility Connectivity (0.13) maturity score reinforces the root issue: water and energy consumption remain largely invisible, so optimization cannot be managed with discipline.



The Cost of Quality: Scrap and Rejection Risk



Process Quality KPI (61%) ranks second, reflecting the direct commercial impact of quality losses across fabric, dyeing, and garment stages. Shade variation in dyeing, sewing defects, and fabric faults translate quickly into rework, claims, and rejection risk in export markets. Low maturity in Shopfloor Intelligence (0.73) and Enterprise Intelligence (0.88) indicates that quality control is still concentrated at final inspection. This keeps the system reactive, increases waste, and raises unit costs. For Europe-facing exporters, the downside is bigger: it directly affects customer confidence and brand value.

Labor-Intensive Production



Textile, leather, and apparel remain among Türkiye's most labor-intensive industries. This is most pronounced in apparel and ready-to-wear, where sewing, in-line quality checks, and packing are still largely manual. The result is a high labor share (20%) in total costs and a strong focus on Workforce Efficiency KPI (61%). Yet productivity is difficult to scale with weak automation and limited data visibility. Advanced applications such as robotic sewing and smart equipment are still rare, and low Shopfloor Connectivity, with an average maturity score of 0.28, limits consistent measurement of labor performance and loss drivers. Over time, this creates a sustainability risk for a competitiveness model built primarily on labor cost advantage. Strengthening automation, connectivity, and workforce capability is the most direct path to de-risking that model.



Machinery and Inventory Pitfalls



Asset & Equipment Efficiency (39%) and Inventory Efficiency (29%) remain relatively low priorities in KPI selection, and both show up as structural weak points. In larger companies, limited lot-level tracking weakens inventory discipline. This is especially visible when matching yarn and fabric stocks to customer-specific orders, where misalignment creates delays and write-offs. In SMEs, the pain point shifts toward maintenance maturity. Limited preventive routines and weak equipment discipline translate into unplanned stops, capacity loss, and unstable throughput. Very low connectivity levels further reinforce the root cause: equipment and inventory data are rarely captured digitally, so losses stay hidden and hard to manage.

The Price of Fast Fashion and Flexibility



Ready-to-wear and apparel operate under a fast-fashion cadence. Global buyers push smaller batches, shorter lead times, and frequent model changes. Flexibility is therefore a commercial requirement, not a nice-to-have. Yet, Production Flexibility KPI is selected at only 25%. The gap is not awareness; it is execution. Without sufficient digital infrastructure and strong strategic governance, flexibility remains an ad-hoc response rather than a managed capability.

Export Dependency and Customer Pressure



A large share of the sector is anchored in EU exports, where quality and delivery performance are continuously tested through customer audits. This raises the bar for transparency, responsiveness, and coordination across the value chain. However, Enterprise Connectivity (0.90) and Inter- & Intra-Company Collaboration (0.90) maturity remain low, indicating limited data sharing with suppliers and customers. Given the fragmented supplier base, this constraint amplifies variability in quality and delivery, and makes it harder to sustain consistent performance at scale.



Textile, Leather, Apparels Roadmap: Digital Breakthrough

1

Digital Scheduling and Line Balancing System: Connect ERP-MES to align orders, machine time, and labor capacity on one view. Strengthen Vertical Integration, lift Planning & Scheduling Effectiveness, and ease Labor Cost pressure.

2

Recipe and Dye Process Management Platform: Digitize recipes and shade control across fabric, dyeing, and finishing. Support Vertical Integration and strengthen Shop Floor Automation and Intelligence, improve Process Quality, and reduce Raw Materials & Consumables losses.

3

Inline Quality Control and Image Processing Systems: Detect defects in-line on sewing, fabric, and dyeing flows via sensors and vision. Improve Vertical Integration and Shop Floor Intelligence, raise Process Quality, and cut rework-driven material losses.

4

Operator Performance and Digital Instruction Program: Standardize execution on apparel lines with digital work instructions and guided workflows. Support Vertical Integration and Shop Floor Intelligence, improve Workforce Efficiency, and reduce variability in labor performance.

Lot and Batch Traceability Platform: Implement lot-level tracking and batch matching from yarn to finished goods. Strengthen Vertical Integration and Enterprise Intelligence, improve Inventory Efficiency, and reduce working-capital lock-up.

Supplier - Customer Collaboration Platform: Sharing quality and delivery data on a common platform for exports to the EU market and within multi-tier supply chains; supports Inter- & Intra-Company Collaboration and Horizontal Integration, improves Process Quality & Time-to-Delivery KPIs, and reduces Transportation & Distribution Cost pressure.

Energy & Water Monitoring and Optimization System: Build real-time visibility for water, steam, and energy use in dyeing and finishing, where the load is structurally higher. Improve Shop Floor Intelligence, reinforce Utilities Efficiency, and reduce utilities volatility beyond the headline average.

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MEXT Türkiye Industrial Insights

The 5 Front-Runner Industries of Türkiye

Transportation



SIRI Overall Score: **1.52**

Electronics



SIRI Overall Score: **1.46**

**Fast Moving
Consumer Goods**



SIRI Overall Score: **1.36**

Chemical



SIRI Overall Score: **1.29**

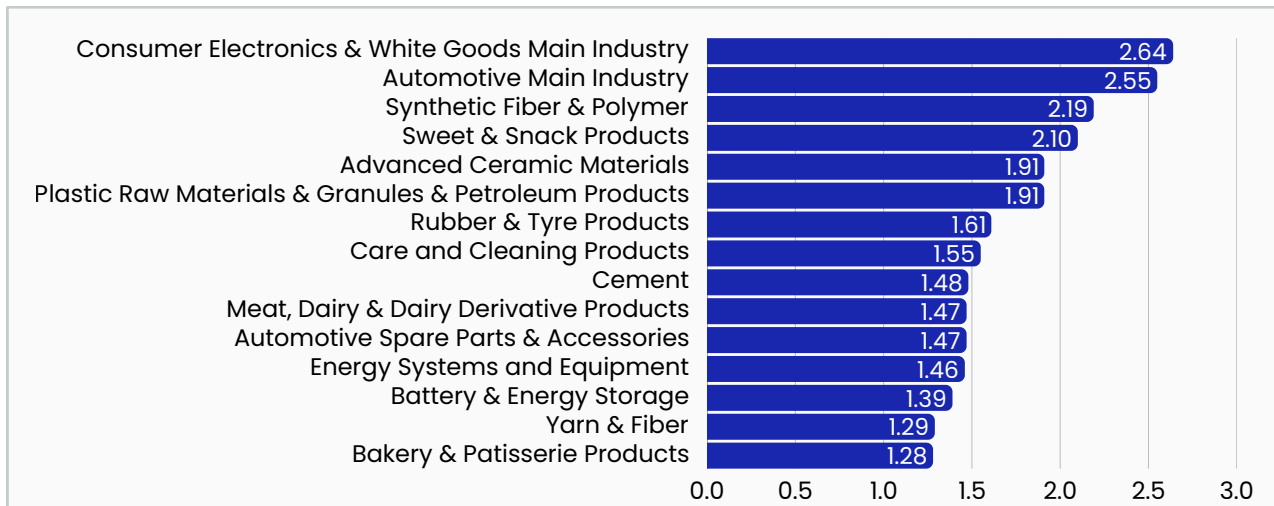
Metal & Mining



SIRI Overall Score: **1.18**

3.5. Türkiye's Digital Front-Runners by Sub-Industry

Figure 36 | Türkiye Sub-industry SIRI Digital Maturity Ranking



Electronics & Home Appliances and Automotive lead the pack, with average maturity scores of 2.64 and 2.55. Their early digital investments were largely shaped by deep integration into global value chains and stringent customer expectations on quality and traceability. The result is a “pull effect” that pushes digital requirements down to suppliers and adjacent industries. Chemical-led sub-segments, including synthetic fibers, polymers, and plastic raw materials, also sit ahead of the curve. The need for consistent specifications, tight quality control, and energy discipline accelerates digitalization in these operations. Because these materials feed textiles and packaging, progress here cascades upstream and helps set the pace across multiple value chains. Within FMCG, confectionery and snacks stand out at 2.10. High-volume operations, shelf-life constraints, and traceability needs have supported stronger planning and quality capabilities.

However, if the gap versus lower-performing sub-segments such as dairy and bakery persists, end-to-end efficiency will remain uneven across the category. Ceramics (1.91) and rubber (1.61) perform above the broader average and can act as “high-traction intermediates.” In ceramics, energy-intensive processes create a clear business case for tighter process control. In rubber, supplier pressure from automotive and white goods accelerates standardization and discipline. These sectors can be practical reference points for scaling proven patterns into mid-maturity industries. In contrast, energy equipment, batteries, and storage (1.39–1.46) remain relatively behind, despite being strategic for the energy transition and e-mobility. Low maturity here increases the risk of long-term technology dependency. Targeted incentives and capability-building partnerships can accelerate digital depth and improve competitiveness in these critical segments.

Türkiye’s digitalization trajectory is becoming more polarized, with progress increasingly concentrated in a small set of leading industries. Supplier networks can be pulled forward through the standards and expectations set by electronics and automotive. However, without targeted support for energy equipment, traditional food, and textile sub-segments, the gap between “high-tech islands” and the broader industrial base will widen further.

3.6. Applying The 3B Benchmark to Turkish Industries

Figure 37 | Distribution of Industries Across 3B Benchmark

		Bottom	Broad Middle	BIC
Advanced Manufacturing		5%	93%	2%
Chemical		3%	81%	16%
Electronics		4%	75%	21%
Energy		0%	75%	25%
Fast Moving Consumer Goods		15%	70%	15%
General Manufacturing		16%	80%	4%
Metal & Mining		5%	95%	0%
Paper		25%	25%	50%
Pharmaceuticals & Healthcare		13%	87%	0%
Textile, Leather, Apparels		15%	84%	1%
Transportation		2%	72%	26%

Different industries in Türkiye are charting different paths on their digital transformation journey. While “falling behind” has become nearly impossible in some industries, others are stuck in the broad middle band, and still others are strongly positioned among both the best and the weakest.

Within this framework, the picture can be interpreted under five distinct strategic patterns:

- Transportation and Electronics, which are part of the mandatory digitalization chain;
- Chemical, protected from the bottom by regulation;
- FMCG, which is divided into two;
- Metal & Mining and Advanced Manufacturing, stuck in the broad middle;
- General Manufacturing, Textiles, and Pharmaceuticals & Healthcare, which experience both bottom density and a lack of leadership.

1. “Mandatory digitalization chain” – Transportation and Electronics

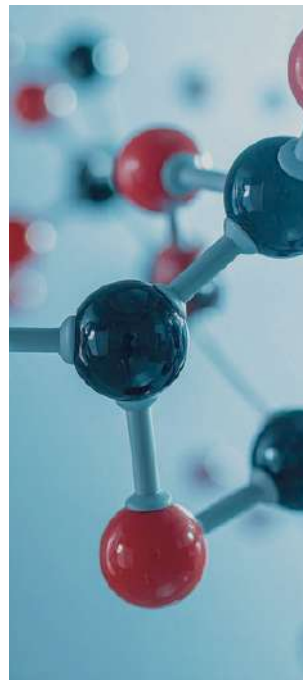
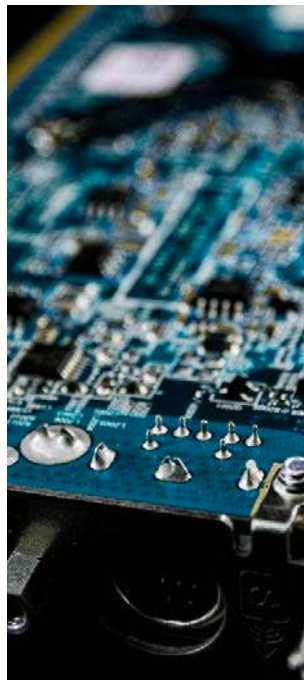
These two industries rank highest in digital maturity in Türkiye. Nearly none of the companies are in the lowest class; instead, a significant portion are among the best. The main reason for this is the high thresholds imposed by integration into global supply chains. In the automotive and electronics industries, issues such as quality certification, traceability, and data integrity have become not only a competitive advantage but also a prerequisite for market entry. Therefore, the option of “staying at the bottom” has effectively disappeared in these industries; companies have either achieved a certain digital minimum or exited the market. This explains the concentration of the distribution towards the upper and middle bands.

2. “Protected from the bottom by regulation, preparing for the top” – Chemical

The chemical industry has almost no companies at the bottom. This is largely due to the requirements imposed by process safety and environmental regulations. It is impossible to operate in chemical production without traceability, process control, and safety systems. However, despite this, the industry is still in the middle ranks in terms of average maturity. The reason for this is its heterogeneous structure: on the one hand, there are large-scale continuous processes, and on the other, smaller-scale batch-based producers. This second group has not yet achieved advanced integration. This picture suggests that Chemical could move from the middle band to the upper class in the next phase, similar to Transportation and Electronics.

3. “Split chain” – FMCG

The distribution profile of FMCG is quite polarized. On one side are branded, high-volume producers; in this group, line sensors, cold chain tracking, and digital planning are more common. On the other side are low-margin, contract or private label manufacturers. In this second group, digitalization investments are mostly postponed, and companies operate using more traditional methods. As a result, the industry has a significant number of companies at both the top and bottom ends. This variance reflects the industry's inherent characteristics: short shelf life, demand fluctuations, and intense promotional pressure. If retailer data sharing and planning integration do not become widespread, this polarization is likely to become permanent.



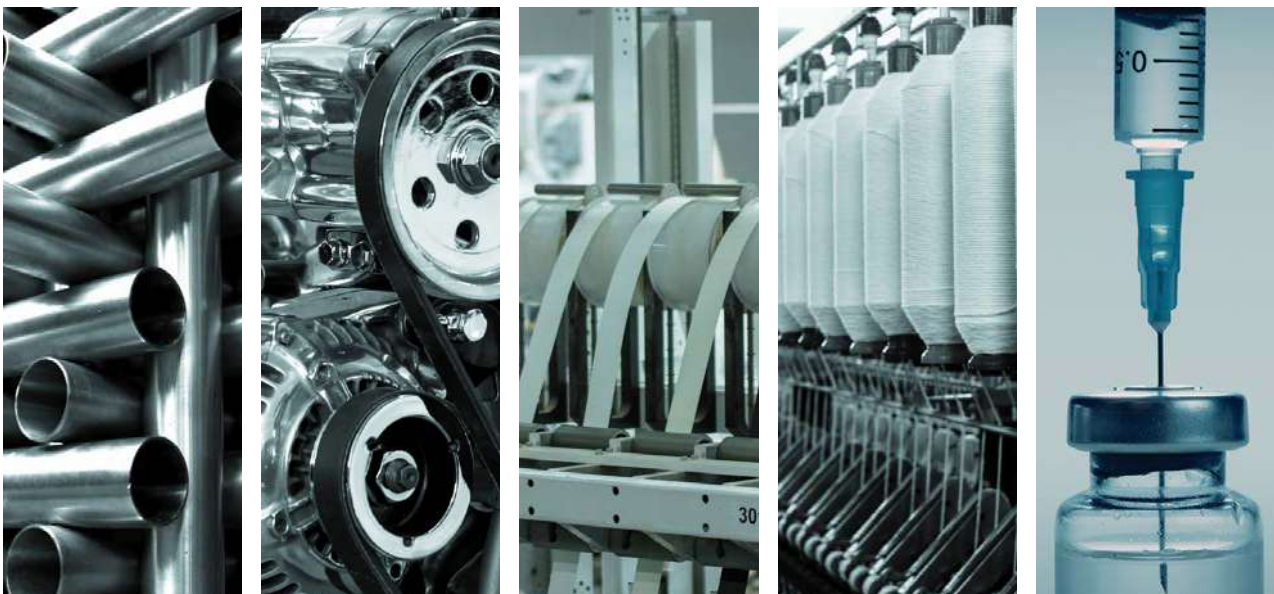
4. “Middle band trap” – Metal & Mining and Advanced Manufacturing

The behavior of these two industries is strikingly similar: there are few companies at the bottom, and almost no players at the top. Nearly all companies are stuck in the middle band. The reason lies in the nature of these industries. In the metal and mining industries, the pace of digitalization is limited due to long-lived assets, high fixed investments, and low IT/OT integration. Advanced Manufacturing, on the other hand, has a fragmented and heterogeneous structure: sub-industries such as metal processing, machinery, and components consist of medium-sized manufacturers. These companies have made basic integrations and moved away from the bottom, but they have not yet sufficiently felt the scale, project discipline, or customer pressure required to move to advanced levels. Therefore, Türkiye's average digitalization profile mimics these two industries: a strong middle band, a limited number of leaders.

5. “The trio of low density and lack of leaders” – General Manufacturing, Textile, Pharmaceuticals & Healthcare

These three industries have low average scores and are unable to generate BIC. The root causes vary across layers, but the outcomes are similar.

- **Textile:** There is a labor-intensive, low-margin structure that produces to order. Digitalization investments are constantly postponed due to short-term cash flow pressure. There is high pressure for diversity and speed in production, but companies mostly survive using simple methods (manual schedules, Excel, limited ERP). This keeps the industry at the bottom. Furthermore, the scarcity of large-scale, branded players hinders BIC extraction.
- **General Manufacturing:** The problem here is a highly fragmented structure dominated by SMEs. Most companies are workshop-type businesses surviving on low capital. Even the most basic investments, such as ERP/MRP, warehouse automation, or data integration, are considered a luxury. This increases the Bottom intensity. On the other hand, even the major players within the industry generally remain at the level of “process standardization,” making it very difficult to achieve BIC.
- **Pharmaceuticals & Healthcare:** Here, the situation is more complex. Regulatory requirements (GMP, validation, batch records) are already high, but companies mostly manage these processes using paper and manual methods. In other words, “there is compliance, but no digitalization.” As a result, there is a significant gap because data integrity and integration cannot be achieved. The reason for the lack of BIC is that the industry in Türkiye is focused on cost-driven production rather than global R&D and innovation.



Chapter 4 | MEXT: A Five-Year Journey of Industrial Transformation

Founded in 2020 by the Turkish Employers' Association of Metal Industries (MESS), MEXT has rapidly become one of the world's most comprehensive and influential centers dedicated to the digital, green, and AI-driven transformation of industry. Designed as a future focused innovation hub, MEXT serves as a catalyst for sustainable and competitive industrial development across Türkiye and beyond.

Shaping Tomorrow's Industry with MEXT

Over the past five years, MEXT has supported hundreds of companies in their transformation journeys offering end-to-end services that span from strategic assessments to hands on capability building. With its state-of-the-art digital factory, extensive training infrastructure, expert consultant network, and a vibrant innovation ecosystem, MEXT enables companies not only to assess their current digital and sustainability maturity but also to act upon it decisively.

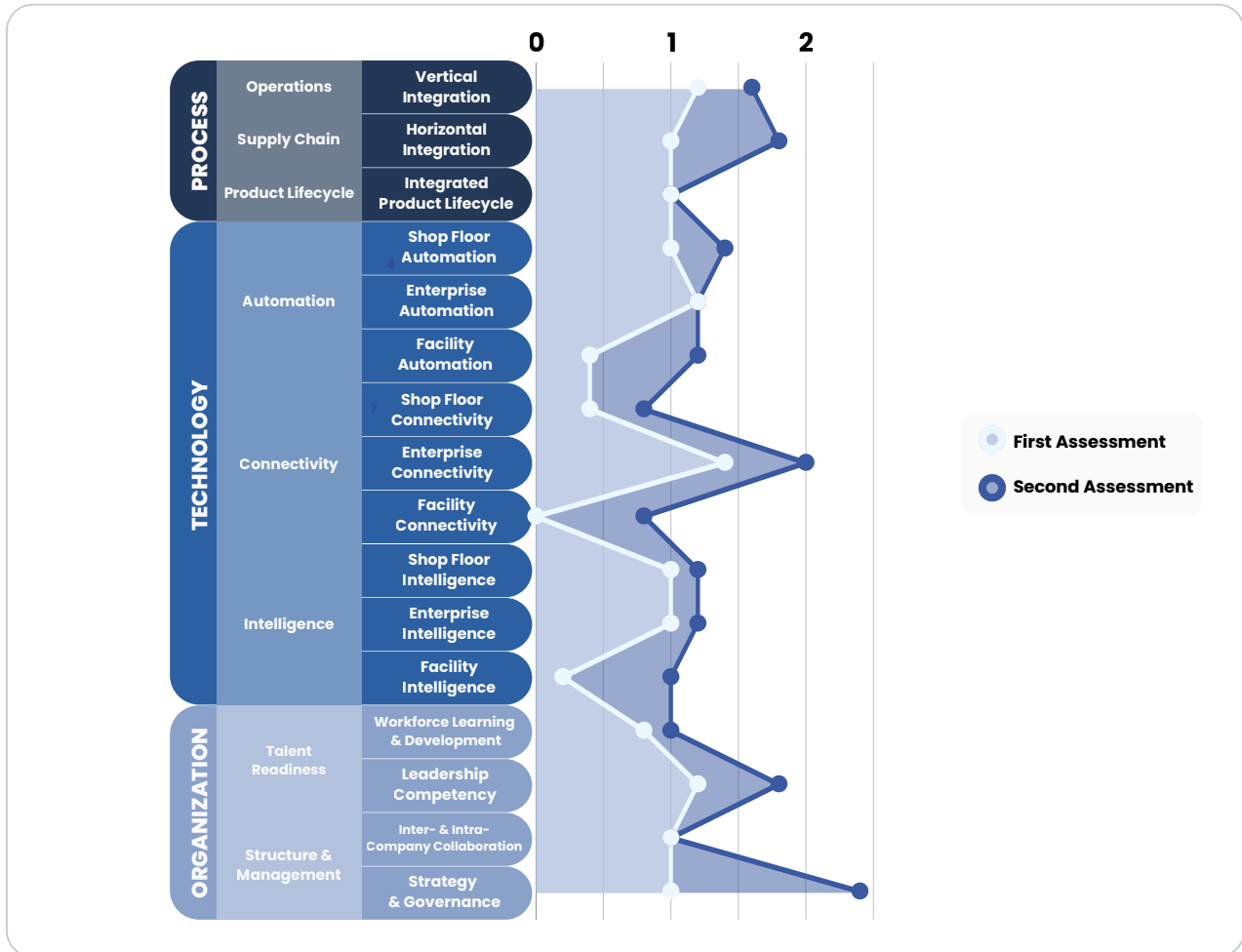
Through close collaboration with industrial enterprises, technology providers, public institutions, and international partners, MEXT has delivered measurable impact across multiple dimensions. From increasing operational efficiency and resilience to embedding data-driven decision-making and building future-ready workforces, MEXT has played a strategic role in shaping Türkiye's industrial evolution. Its role as European Digital Innovation Hub (EDIH) further reflects its commitment to global standards and cross-border collaboration.

The following page illustrates the results of two consecutive SIRI assessments conducted with the same companies, as well as how the resulting strategic roadmaps have tangibly shaped their digital transformation journeys. By establishing a clear maturity baseline, identifying structural gaps and value levers across SIRI dimensions, and tracking progress over time, the assessments enabled companies to sharpen priorities and strengthen organizational alignment. As a result, transformation roadmaps were executed with greater focus and speed. This is followed by selected success stories from companies that moved beyond adoption and translated transformation into sustained strategic advantage. These cases demonstrate how structured diagnostics, expert guidance, and ecosystem collaboration convert insight into impact. The outcomes range from operational simplification and data-driven decision-making to AI-enabled process optimization, digital traceability, and greener production models. Together, they serve as practical proofs of how disciplined, purpose-driven transformation delivers measurable results. Each success story is a reflection of MEXT's core mission: to empower industry through knowledge, technology, and collaboration and to help every company find its path to a more competitive, sustainable, and innovative future.



4.1. The Impact of a SIRI Assessment

Figure 38 | Progress Following the SIRI Assessment



The second measurement reveals that the SIRI Assessment has triggered awareness in companies on its own and that the implementation of projects has resulted in indirect gains in many dimensions. In other words, SIRI not only identifies the current situation but also acts as a catalyst that accelerates the pace of transformation in companies.

The second assessment shows the strongest improvement in the Operations, Supply Chain, Automation, and Connectivity pillars. These gains indicate that companies have strengthened their core execution capabilities and created more transparent, coordinated, and responsive operational structures.

Progress is more limited in the Product Lifecycle, Intelligence, and Talent Readiness pillars, while Structure & Management shows only moderate improvement. This highlights that although operational and technical foundations are improving, deeper organizational maturity and workforce development remain the key challenges for the next phase of transformation.

4.2. Success Story: Vitra Karo

Leading the Global Ceramics Industry Through Twin Transformation

Vitra Karo, a key subsidiary of the Eczacıbaşı Group and a global ceramic tile brand, became the first and only ceramic tile manufacturer worldwide to be selected for the World Economic Forum's Global Lighthouse Network (GLN) – a prestigious platform recognizing pioneers in digital and green transformation.

Vitra Karo's transformation journey focused on reengineering its Bozüyük production facility using advanced Industry 4.0 technologies and sustainability-driven design principles. With strategic support from MEXT, the company implemented AI-powered systems, real-time analytics, and circular economy practices – significantly enhancing production efficiency, reducing environmental impact, and setting a new global benchmark in a traditionally resource-intensive sector.

About Vitra Karo

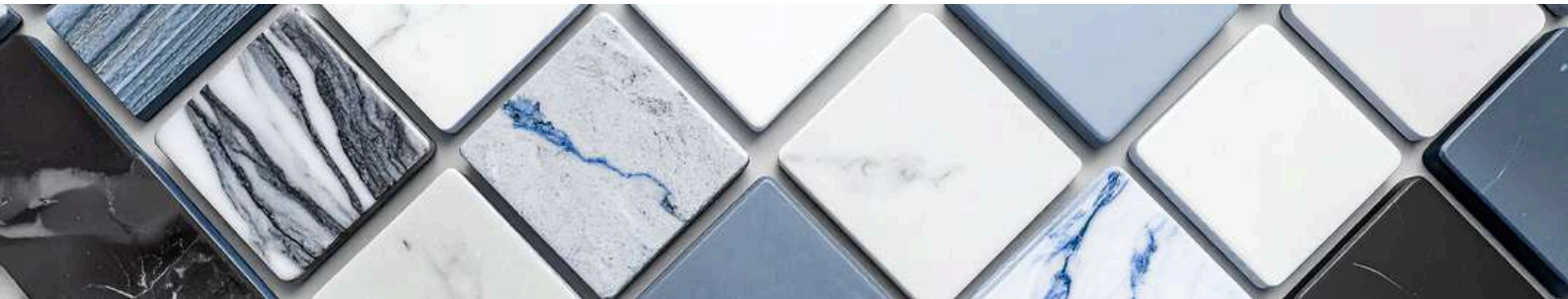
Operating in over 75 countries, Vitra Karo is a leading ceramic tile manufacturer serving the residential, commercial, and architectural segments. Its Bozüyük facility – covering nearly 400,000 square meters with 1,500 employees – has an annual production capacity of 30 million m², making it one of the largest and most technologically advanced tile production hubs in Europe.

Challenge

As global construction and design sectors evolved toward smarter, more sustainable solutions, Vitra Karo faced a dual imperative:

- Digital Complexity: Managing a high-mix, high-volume production system while ensuring traceability, quality, and responsiveness across markets.
- Sustainability Pressure: Reducing energy, waste, and emissions in a sector known for high resource consumption – while meeting the ESG expectations of global buyers.

The leadership recognized that incremental improvements were no longer sufficient; a twin transformation was necessary – integrating digitalization and sustainability into every part of the value chain.



Solutions

1. Digital Maturity Assessment & Roadmap

With the support of MEXT, Vitra Karo underwent a full-scale SIRI digital maturity assessment across its operations. Key gaps were identified in systems integration, data utilization, and production agility. MEXT facilitated a structured roadmap, prioritizing high-impact areas.

2. ERP – MES Integration

Vitra launched DigiTile, a comprehensive digital transformation initiative that included:

- Manufacturing Execution System (MES)
- Industrial IoT (IIoT) and Cloud Integration
- Real-time data Tracking and Analytics
- AI-powered Modules: Machine learning for process optimization, AI-supported decision system for production control, Predictive maintenance and fault detection, AI-based automated quality inspection, Centralized digital production control tower.

3. COSIRI Sustainability Maturity Assessment & Roadmap

Using the COSIRI framework, MEXT assessed environmental maturity across 24 sustainability dimensions. Key outcomes included: Launch of a Life Cycle Assessment (LCA) initiative, Adoption of energy optimization algorithms, Introduction of closed-loop recycling and waste heat recovery.

4. Ecosystem Engagement & Lighthouse Application Support

MEXT guided Vitra Karo through the Global Lighthouse Network application, organizing:

- A Lighthouse Gap Analysis Workshop (April 2023)
- Peer-learning Sessions with Lighthouse-certified Factories
- Final Documentation Review and Strategic Alignment

Impact

The initiatives led to substantial improvements in both operational efficiency and sustainability. OEE increased by 20%, accompanied by faster decision-making, higher production responsiveness, and a notable reduction in quality defects and downtime. At the same time, environmental performance improved significantly, with a 56% reduction in production waste, 15% decrease in energy consumption, and 43% increase in the use of recycled materials.

Conclusion

Vitra Karo's journey to becoming a Lighthouse factory highlights the strategic power of combining digital transformation with sustainability. With expert support from MEXT, and driven by a clear vision from its leadership, Vitra Karo successfully turned industrial challenges into global recognition, proving that even the most traditional industries can lead the future.

4.3. Success Story: Martur Fompak International

Transforming Direct Material Classification Through Agentic AI

In today's highly complex industrial landscape, data-driven decision-making, process automation, and operational excellence are critical pillars for achieving long-term competitiveness. Martur Fompak International, operating across multiple countries with diverse procurement ecosystems, faced significant challenges in managing the classification of direct materials due to data inconsistencies and decentralized systems.

With MEXT's technical guidance and ecosystem support, the company implemented an AI-driven classification system powered by Google Cloud Platform (GCP), Vertex AI, and Agent Development Kit (ADK). The result was a fully automated, intelligent classification framework that not only enhanced procurement efficiency but also laid a foundation for scalable digital transformation across operations.

About Martur Fompak

Martur Fompak International is a global automotive parts manufacturer with operations in Europe, North Africa, and Asia. Known for its innovation-oriented approach, the company sought to standardize its material classification process across all its international branches while minimizing manual intervention and improving data consistency.

Challenge

- Fragmented classification processes across countries and community groups
- Heavy reliance on manual input, increasing error rates and inefficiencies
- Lack of centralized knowledge management and risk of information loss
- No standard classification method, leading to poor data integrity
- Difficulty in generating consistent, strategic procurement reports



Solutions

With support from MEXT, Martur Fompak launched the Direct Material Classification Project, focusing on end-to-end AI-based automation:

- Infrastructure: Built a Cloud Platform
- AI Framework: An AI Platform and Agent Development Kit
- Architecture: Agentic AI-based automation with dynamic decision flows
- Hackathons organized by MEXT further helped refine the solution, bringing cross-disciplinary perspectives and fostering a culture of experimentation and co-creation.

Impact

Direct Improvements

- Centralized knowledge base: Classification models integrated with SAP for version control and instant access
- Automated corrections: AI agents identified and corrected misclassifications using supplier history and external data
- AI-powered agents: 3 intelligent agents orchestrated across GCP for fully automated material classification
- Reduced manual effort: Adaptive decision trees reduced human intervention significantly

Indirect Improvements

- Automated classification for new materials: Leveraging Vertex AI visualization and summarization capabilities
- Interoperability across systems: Consistent data sharing between SAP and AI agents via centralized cloud architecture
- Enhanced data accuracy: Continuous learning agents minimized misclassification risk
- Cross-functional collaboration: Unified agent-based infrastructure allowed for standardized workflows among different departments

Conclusion

This initiative served not only as a technical achievement but also as a transformation in mindset. The project strengthened institutional learning and helped create a scalable, replicable AI use case that demonstrates how classic business functions—like procurement can be radically improved using modern AI tools. By combining MEXT's strategic guidance with Martur Fompak's innovation drive, the project stands as a model for how digital transformation, when grounded in organizational need and AI maturity, delivers tangible and sustainable value.

4.4. Success Story: Unilever Konya Factory

Boosting Energy Efficiency Through AI-Driven Innovation

The Konya factory, a flagship production site in Türkiye, has emerged as a global benchmark for combining high-tech investments with local engineering excellence. With over 30% efficiency improvement in recent years, the facility stands out through its cutting-edge use of artificial intelligence (AI) to drive energy savings and sustainability in detergent production.

Through the Digital Tower project a joint initiative by Unilever and MEXT the Konya plant leveraged AI technology to optimize natural gas consumption in powder detergent manufacturing. This breakthrough not only enhanced operational efficiency but also delivered significant environmental benefits, reinforcing the factory's role as a leader in industrial digitalization and green transformation.

About Unilever Konya Factory

Located in Türkiye's industrial heartland, the Konya factory specializes in detergent production with a focus on operational excellence and sustainability. Supported by a talented engineering team, the facility continuously adopts innovative technologies to maintain competitiveness in global markets.

Challenge

Rising energy costs and stricter environmental regulations posed significant challenges for the detergent production line. The factory needed to reduce energy consumption without compromising product quality or output volume, demanding smarter, data-driven operational controls.



Solutions

AI-Powered Energy Efficiency (Digital Tower Project)

Partnering with Unilever and MEXT, the Konya factory implemented the Digital Tower initiative — an AI-driven system designed to monitor and optimize natural gas usage in real-time during powder detergent production.

Key features included:

- Advanced sensor networks and IoT integration
- AI algorithms for predictive adjustments in process parameters
- Continuous monitoring and automated alerts for inefficiencies

Impact

- 30%+ improvement in overall operational efficiency over three years
- 6% annual reduction in natural gas consumption thanks to AI optimizations
- Prevention of 760 tons of CO₂ emissions per year
- Enhanced sustainability performance aligned with corporate ESG targets

Key Learnings

The Digital Tower project is celebrated as a pioneering example of how digital transformation can deliver measurable environmental impact in manufacturing. It underscores the critical role of AI and data analytics in enabling sustainable industrial operations.

Conclusion

Konya factory's AI-enabled energy efficiency journey demonstrates that investing in digital innovation not only improves operational performance but also advances sustainability goals. Supported by collaborative partnerships and cutting-edge technology, the factory exemplifies how traditional manufacturing sectors can embrace Industry 4.0 and green transformation hand-in-hand.



4.5. Success Story: Chef Seasons

In collaboration with MEXT and Türkiye İş Bankası

Scaling Sustainable Growth Through Digital & Green Transformation

Chef Seasons, a dynamic player in Türkiye's food manufacturing sector, embarked on a twin transformation journey to future-proof its operations amid rising global demands for traceability, sustainability, and agility. Through its partnership with MEXT and Türkiye İş Bankası, the company adopted a data-driven approach to digitalization and environmental performance, enabling measurable gains across operational efficiency, cost competitiveness, and ESG alignment.

What sets this transformation apart is the strategic integration of technology and sustainability, not as parallel initiatives, but as interdependent enablers of long-term growth. Leveraging global frameworks such as SIRI and COSIRI, Chef Seasons restructured its production systems, digitized its value chain, adopted renewable energy, and embedded circular practices into its product design.

The result is not only a more resilient and efficient enterprise, but one that has earned international recognition for aligning business performance with planetary boundaries. Chef Seasons' journey demonstrates that for forward-thinking SMEs, twin transformation is not a future goal—it is a present imperative and a powerful lever for global competitiveness.

Following the twin transformation, Chef Seasons joined MEXT's Agentic AI Hackathon, exploring use cases in customer experience, order management, and supply chain optimization. The company gained hands-on experience in cloud-based AI architectures, developing a tailored roadmap for AI adoption.

About Chef Seasons

Chef Seasons operates in the B2B and B2C segments of the food manufacturing industry, offering innovative, traceable, and sustainable products to both local and global markets. With a strong focus on quality and food safety, the company sought to future-proof its operations through a comprehensive transformation strategy.

Challenge

As the company scaled operations and expanded internationally, Chef Seasons faced increasing complexity in supply chain management, inventory control, and production efficiency. In parallel, growing environmental expectations from global buyers demanded a transparent and measurable approach to sustainability. The leadership recognized the need for a holistic transformation—spanning both digital infrastructure and sustainability practices.



Solutions

1. SIRI Digital Maturity Assessment & Roadmap

MEXT conducted a detailed digital maturity assessment using the Smart Industry Readiness Index (SIRI) framework. The analysis revealed key improvement areas in data integration, traceability, and production planning. A comprehensive transformation roadmap was developed to prioritize investment areas and implementation timelines.

2. ERP – MES Integration

Chef Seasons deployed enterprise resource planning (ERP) and manufacturing execution systems (MES) across all processes. Real-time data flow across supply chain, production, and sales functions led to: 7% reduction in inventory backlog, Increased forecast accuracy and production responsiveness 8% increase in OEE through AI-powered image recognition and bottleneck detection.

3. COSIRI Sustainability Maturity Assessment & Roadmap

MEXT led a 24-criteria sustainability assessment across corporate and operational levels. A key insight emerged: environmental product data was critical for competitive positioning in export markets. Chef Seasons launched a Life Cycle Assessment (LCA) project, supported by TÜBİTAK's 1831 Green Innovation Grant (90% funding coverage). Outcomes included: 68% reduction in packaging-related carbon emissions, 18% decrease in water consumption, 12% lower energy usage, and 45% recyclable waste rate achieved.

4. Renewable Energy Transition

The company transitioned to 100% renewable electricity in production and committed to carbon offsetting via the annual planting of over 10,000 trees.

Impact

- Gross profit margin increased from 18.5% to 24%
- Significant reduction in operational disruptions and downtime
- Enhanced global visibility and recognition in sustainability leadership

Chef Seasons was featured as a case example in the World Economic Forum's "Sustainability Meets Growth" report, positioning the company as a global role model for SME transformation. In 2024, the company received the Corporate Social Responsibility Award at SIAL Paris, one of the world's leading food innovation fairs.

Conclusion

The Chef Seasons case exemplifies how SMEs in traditional sectors can achieve global competitiveness by aligning digital and green transformation strategies. With MEXT's methodological support and Türkiye İş Bankası's targeted financial mechanisms, Chef Seasons transformed not only its operations but also its long-term value proposition, creating impact across business performance, environmental stewardship, and global positioning.

MEXT

TÜRKİYE'S MANUFACTURING TRANSFORMATION INSIGHTS REPORT 5 YEARS | 500 FACTORIES



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Acknowledgments

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Appendix 1

The SIRI's 10 Cost Profiles

Cost Category	Description
 Aftermarket Services / Warranty	Describe expenses that the company expects to or has already incurred for the repair or replacement of goods that it has sold. The total expense is limited by the warranty period that the company provides.
 Depreciation	A non-cash expense representing the portion of all fixed assets owned by the company that has been considered consumed over an accounting or financial period.
 Labour	The sum of all wages paid to employees, as well as the cost of employee benefits and payroll taxes paid by an employer.
 Maintenance & Repair	All expenses required to bring capital assets – such as building, infrastructure, equipment, and machinery – back to good working order, or to keep them operating in optimal condition.
 Raw Materials & Consumables	Inventory of all component parts currently in stock that have not yet been used in work-in-process or finished goods production. They include both direct materials, which are incorporated into the final product, and indirect materials that are consumed during the production process
 Rental & Operating Lease	Costs associated with the use of assets which the company does not own. These include but are not limited to property, plant, and equipment.
 Research & Development	All expenses relating to activities for the development or improvement of products or processes, such as product design improvement and production process enhancement.
 Selling, General & Administrative Expenses ("SG&A")	All operating expenses which are not directly tied to the cost of making a product. These include corporate, accounting, legal, sales, and marketing expenses
 Utilities	Cost of electricity, heat (gas/fuel), sewer, and water used by a factory or plant to ensure the smooth running of both the direct manufacturing process and its surrounding environmental conditions
 Transportation & Distribution	All expenses relating to the transportation of goods from one location to another.

Appendix 2

The SIRI's 14 KPI Categories

KPI Category	Description
Asset & Equipment Efficiency	Asset & Equipment Efficiency evaluate a company's capacity to maximize the utilization of its assets and machinery by improving factors including overall equipment effectiveness ("OEE"), the frequency of unplanned downtime, the lifespan of its assets, and unit throughput.
Workforce Efficiency	Workforce Efficiency evaluates the direct and indirect labor productivity and man-hours spent per task in a company.
Utilities Efficiency	Utilities Efficiency takes into consideration the amount of energy and water consumed, as well as emissions and wastewater produced by a company's manufacturing operations.
Inventory Efficiency	Inventory Efficiency aims to guide manufacturers in minimizing the average volume of inventory required and unnecessary burden stocks, additional costs resulting from higher land and/or building rentals.
Material Efficiency	Material Efficiency assesses a company's efforts to optimize the use of raw materials in its manufacturing process, either by utilizing fewer inputs for the same amount of output or recycling a greater proportion of unused inputs for subsequent production.
Process Quality	Process Quality evaluates a company's ability to uphold the integrity of the processes within the factory/plant, by minimizing the deviations from the intended parameters and conditions.
Product Quality	Product Quality emphasizes the company's ability in producing a low percentage of defective products – both work-in-process and finished goods – and that all products are manufactured as closely to the target specifications as possible.
Safety	Safety KPI considers the number of workplace safety incidents, ergonomic issues and near misses in the company's facilities.
Security	Security KPI assesses the number of security breaches, the interconnectivity of assets, and the number of penetration attempts in the company's facilities.
Planning & Scheduling Effectiveness	KPIs in this category focus on the manufacturer's level of proficiency to effectively plan and schedule tasks, handle the volatilities of market demand and supply, take on and fulfil orders on short notice.
Production Flexibility	Production Flexibility is where equipment, machinery and computer-based systems can be modified, reconfigured and re-tasked quickly and easily when needed.
Workforce Flexibility	Workforce Flexibility is the ability of a company's workforce to perform a variety of different job functions.
Time to Market ("TTM")	Time-to-Market measures the length of time it takes for a company to conceive a new product, or augment an existing one, and launch it in the market.
Time to Delivery	Time to Delivery is the length of time it takes for a company to produce and deliver the finished products to the end-customers from the initiation of the project or contract.

Appendix 3

Acronyms Used in This Report

Acronyms	Meaning
3B	Bottom, Broad-Middle, Best-in-Class
AI	Artificial Intelligence
AOI	Automated Optical Inspection
API	Application Programming Interface
APQP	Advanced Product Quality Planning
AR	Augmented Reality
AXI	Automated X-Ray Inspection
B2B	Business to Business
B2C	Business to Consumer
BI	Business Intelligence
BIC	Best-in-Class
BMS	Building Management System
CAD	Computer-Aided Design
CAPA	Corrective & Preventive Action
CAPEX	Capital Expenses
CBAM	Carbon Border Adjustment Mechanism
CNC	Computer Numerical Control
COSIRI	Consumer Sustainability Industry Readiness Index
CRM	Customer Relationship Management
EBR	Electronic Batch Record
EDI	Electronic Data Interchange
EDIH	European Digital Innovation Hub
EMA	European Medicines Agency
EMC	Electromagnetic Compatibility
EMS	Electronics Manufacturing Services
ERP	Enterprise Resource Planning
ESG	Environment, Social, Governance
FDA	Food & Drug Administration
FEFO	First Expired, First Out
FIFO	First in, First Out
FMCG	Fast Moving Consumer Goods
GenAI	Generative Artificial Intelligence
GDP	Gross Domestic Product
GLN	Global Lighthouse Network
GMP	Good Manufacturing Practice
HEPA	High Efficiency Particulate Air
HRMS	Human Resources Management System
HVAC	Heating, Ventilation & Air Conditioning
IBP	Integrated Business Planning
IIoT	Industrial Internet of Things
IoT	Internet of Things
IPL	Integrated Product Lifecycle

Acronyms	Meaning
ISO 100	Türkiye's 100 Largest Industrial Companies
IT	Information Technology
JIT	Just-in-Time
KPI	Key Performance Indicator
LCA	Lifecycle Assessment
LIMS	Laboratory Information Management System
MES	Manufacturing Execution System
MIS	Manufacturing Information System
MNC	Multinational Corporations
MRP	Material Requirements Planning
NADCAP	National Aerospace & Defence Contractors Accreditation Programme
NC	Numerical Control
NDT	Non-Destructive Testing
OEE	Overall Equipment Effectiveness
OEM	Original Equipment Manufacturer
OPC-UA	Open Platform Communications - Unified Architecture
OT	Operational Technology
PLM	Product Lifecycle Management
PMO	Project Management Office
PPAP	Product Part Approval Process
QMS	Quality Management System
R&D	Research & Development
RFID	Radio Frequency Identification
ROI	Rate of Investment
RPA	Robotic Process Automation
S&GA	Selling, General & Administrative
S&OP	Sales & Operations Planning
SCADA	Supervisory Control and Data Acquisition
SCM	Supply Chain Management
SIAL	Salon International de l'Alimentation
SIRI	Smart Industry Readiness Index
SKU	Stock-keeping Unit
SME	Small & Medium-sized Enterprises
SMED	Single Minute Exchange of Dies
SMT	Surface Mount Technology
SOP	Standard Operating Procedure
SPC	Statistical Process Control
SRM	Supplier Relationship Management
WFI	Water for Injection
WMS	Warehouse Management System

Endnotes

1. For more information on the Official SIRI Assessment and the evaluation scope, please refer to: International Centre for Industrial Transformation (INCIT), Smart Industry Readiness Index, <https://incit.org/what-we-do/siri/>
3. For more information on the Acatech Maturity Index, please refer to: Schuh, G., Anderl, R., Dumitrescu, R., Krüger, A., & ten Hompel, M., Using the Industrie 4.0 Maturity Index in Industry. Current challenges, case studies and trends, 2020, <https://en.acatech.de/publication/using-the-industrie-4-0-maturity-index-in-industry-case-studies/>.
4. For more information on the analysis, please refer to: International Centre for Industrial Transformation (INCIT), The Global Smart Industry Readiness Index Initiative: Manufacturing Transformation Insights Report 2025, 2025, <https://incit.org/case-studies/the-global-smart-industry-readiness-index-siri-initiative-manufacturing-transformation-insight-report-2025/>.
5. For more information on the İSO 500 ranking, Türkiye's largest 500 companies, please refer to: <https://www.iso500.org.tr/500-buyuk-sanayi-kurulusu>
6. An SME is defined as any organization with fewer than 250 employees and has an annual net sales revenue or financial statement less than 1 Billion ₺ (Source: KOSGEB)

TÜRKİYE'S MANUFACTURING TRANSFORMATION INSIGHTS REPORT

2026

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